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ABSTRACT

The secondary science activities materials developed by the North Dakota Exemplary Project represent information that will be helpful to teachers in achieving the goals of a career education program. The guide provides a flexible framework to provide experiences that will support the learning principles needed to attain the required knowledge, attitudes, and skills essential to productive living integrated into the existing curriculum. A brief explanation is offered of career education--its definition, philosophy for the secondary level, specific secondary objectives, summary of career education objectives, and the need for career education. The needs of the students, involvement in the world of work, and classroom facilities should set the stage for the selection of resource units to be used. Within the science area, activities are organized by the career education elements of: self awareness, career awareness, and skill awareness. Each broad objective includes specific behavioral objectives, a suggested subject area and grade level, learning activities, suggested teaching techniques, resource materials, and worksheets. Supplemental materials are appended. (Author/BP)

ED105091

EMPLOYABILITY SKILLS

SELF-AWARENESS

WORK ATTITUDES

SCIENCE

ENVIRONMENT

TECHNOLOGY

GRADES 7-12

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CE003 332

Secondary Science Activities
of the
North Dakota Exemplary Project in Career Education

Conducted Under
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PREFACE

The 1968 Vocational Education Amendments called attention to the need for innovative programs in education that would help students bridge the gap between school and work. In response to this legislation the State Board for Vocational Education in cooperation with the Department of Public Instruction, the Bismarck Public School District, and others have initiated a developmental program in Career Education. This program has been developed and field tested in the Bismarck District and other schools that have asked to become involved during 1970 - 1973.

The following materials have been compiled by the staff of North Dakota's Exemplary Career Education Program with the assistance of many individuals and groups. The contents are designed as ideas that could be used to develop various Career Education concepts and objectives. The activities are to be integrated into your existing curriculum, sequenced, and adapted to meet the needs of all people involved in education at the local school.

ACKNOWLEDGMENTS

The staff of the State Exemplary Project in Career Education gratefully acknowledge the help of the teachers, administrators and counselors in the Bismarck Public Schools for assistance in the development and field-testing of the suggested activities.

In addition to the personnel in the Bismarck School District many individuals and groups contributed to furthering the effort of Career Education in North Dakota. The project staff extends a special thank you to the staff of the State Board for Vocational Education, members of the Department of Public Instruction, and all other school districts, agencies, and individuals that helped make this publication a reality.

PURPOSE OF THIS GUIDELINE

The Career Education reference material included in this guideline represents information that will be helpful to teachers in achieving the goals of a Career Education program.

The guide provides a flexible framework to provide experiences that will support the learning principles needed to attain the required knowledge, attitudes and skills essential to productive living. Within this flexibility, there is no planned sequence of study in this guide. The needs of the students, the involvement in the world of work and the classroom facilities should set the stage for the selection of resource units to be utilized.

This guide does not provide a framework for a separate unit on careers. Rather, it is expected that learning experiences from the guide will be incorporated into existing units of instruction.

This guide is organized around 16 major objectives. To achieve these objectives the activities include expected student behavior and suggested learning experiences. Teachers are encouraged to add other goals and learning experiences which they have found successful.

The Career Education activities in this guide have been organized in the Table of Contents as they relate to the elements of the Career Education Program. With this structure, the teacher has a ready reference for the selection of an activity appropriate for working with that element. In using the activities, the classroom teacher should make special note of the format as it applies to the student and teacher needs. Provisions have been made for a broad objective and supportive techniques. Also, suggested resources have been listed to help the teacher and student work out a plan of study. It is not intended that the teacher be limited to the activity as presented. Rather, it is to be thought of as a point of departure in accomplishing the desired objectives.

DEFINITION OF CAREER EDUCATION

"Career Education represents the total effort of public education and the community to help all individuals become familiar with the value of a work oriented society, to integrate those values into their personal value structure, and to implement those values in their lives in ways that make work possible, meaningful, and satisfying to each individual." Dr. Kenneth Hoyt

Career Education is an integral part of education. It is a concept that includes as its main thrust the preparation of all students for a successful life of work by increasing their options for occupational choice and attainment of job skills, and by enhancing learning achievement in all subject matter areas. Career Education is a series of growth experiences which begins in the home and continues at the pre-school and elementary, junior high and senior high, post-secondary and adult levels of education. Emphasis is placed on career awareness, orientation and exploration of the world of work, decision-making relative to additional education, preparation for employment, and understanding the interrelationship between a career and one's life style. It provides purposefully planned and meaningfully taught experiences which contribute to self-development as it relates to various career patterns. Career Education calls for a total effort of the home, school and community to help all individuals become familiar with the values of a work oriented society, to integrate these values in their lives in a way that work becomes useful, meaningful and satisfying.

CAREER EDUCATION PHILOSOPHY

Secondary

Career Education is that one aspect of life-long individual development which relates to the occupational needs of the individual and which occurs with social, emotional, intellectual and general personal development. All facets of individual development are integrated with each other in a life-long continuing process.

Career Education in the secondary school provides for broad based occupational exploration including classroom, shop, laboratory and field experiences in a variety of occupational areas.

It is designed to assist secondary students, through an interdisciplinary approach, develop a more realistic plan for their own careers. The activities provide for further development of self-concept, self-appraisal of abilities, interests and aptitudes; understanding of education avenues; appreciation of economic and social values of work and an awareness of the decision-making process.

The decision-making process is an important facet of career development at the secondary level. The student relies heavily on pre-high school experiences relating to awareness and exploration experiences of the individual in the career education activities on the elementary level.

The decision-making process is not a "one shot" deal but rather an end result of many experiences throughout the lifetime of an individual. Whether or not the decision will be a realistic one for the individual depends on how he sees himself in relation to the total picture. Therefore, career education necessarily becomes a lifetime process since decisions are constantly being made by the individual.

Educational curriculums and other experiences usually consider the physical, emotional, intellectual, and general educational development but, unless coincidental, fail to consider the other aspect of career education in the overall educational process. In light of this void in the curriculum, activities or experiences must be provided each student by the classroom teacher. No one individual or department in the school system can achieve the desired goals alone.

Many of the activities provide an opportunity for the students to visit the business community and observe workers on the job at all levels, including semi-skilled, skilled, technical, and professional occupations. Students will interview workers to learn their respective feelings about their occupation, the educational requirements, work settings, benefits, work hours, and job characteristics relative to self-characteristics.

The secondary student must be cognizant of the options before him and through classroom or subject matter related experience be reminded of the resources, both intellectual and materialistic, from which he can draw in making a realistic decision; he must be equipped to deal with the decision as it affects his future; be prepared to make necessary adjustments demanded by his environment; in general begin planning and preparing for adult living.

SPECIFIC SECONDARY OBJECTIVES

1. To create self-awareness of students' interests, abilities and aptitudes.
2. To help students set realistic goals in light of knowledge about themselves.
3. To relate that technology affects the number and types of careers and to illustrate the interdependency of workers.
4. To acquaint students with the various aspects of community job resources, job hunting, applying, interviewing and securing employment.
5. To show a relationship between school subjects and opportunities that exist throughout life.
6. To familiarize students with sources and uses of occupational materials in the library and/or counselor's office.
7. To become aware of employment trends and outlooks, employer-employee relationsips and the distribution and mobility of employed persons.
8. To investigate projected needs for various workers and the career patterns involved with these workers.
9. To acquaint students with the basic economics, budgeting, and the importance of fringe benefits when considering employment.
10. To acquaint students with labor unions, apprenticeship programs, and journeyman programs.
11. To expose students to a full range of occupational opportunities.
12. To understand goals, values, and aspirations and how they relate to the choice of a career.
13. To develop basic problem-solving*techniques.
14. To acquaint students with the need for continuing education.
15. To help students make a realistic choice of post-secondary plans.
16. To help students make the necessary adjustments for adult living.

SUMMARY OF CAREER EDUCATION OBJECTIVES

I. PREPARE FOR MAKING CAREER DECISIONS

- A. Know own characteristics relevant to career decisions.
- B. Know the characteristics and requirement of different careers and occupations.
- C. Relate own personal characteristics to occupational requirements.
- D. Plan for career education or change.

II. IMPROVE CAREER AND OCCUPATIONAL CAPABILITIES

III. POSSESS SKILLS THAT ARE GENERALLY USEFUL IN THE WORLD OF WORK

- A. Have generally useful numerical skills.
- B. Have generally useful communication skills.
- C. Have generally useful manual-processing and decision-making skills.
- D. Have generally useful interpersonal skills.
- E. Have employment-seeking skills.

IV. PRACTICE EFFECTIVE WORK HABITS

- A. Assume responsibility for own behavior.
- B. Plan work.
- C. Use initiative and ingenuity to fulfill responsibilities.
- D. Adapt to varied conditions.
- E. Maintain good health and grooming.

V. HAVE POSITIVE ATTITUDES TOWARD WORK

- A. Recognize the basis of various attitudes toward work.
- B. Hold competence and excellence in high regard.
- C. Seek personal fulfillment through own achievements.
- D. Value work in terms of societal goals.
- E. Pride in work improves quality.

VI. HAVE A POSITIVE IMAGE OF SELF

- A. Understand feelings toward myself and others.
- B. Understand and accept my similarities and differences.
- C. Identify, clarify, accept, or change my values.
- D. Assume responsibility toward self and society.
- E. Recognize inherent capabilities.

NEED FOR CAREER EDUCATION

A fundamental purpose of education is to prepare people to live a productive and rewarding life. For far too many Americans our schools are failing in this essential mission.

In typical schools throughout the country young people complain that curriculums are dull and irrelevant, that their education is not opening pathways to a fulfilling adulthood. Substantial numbers of students score below their grade level in basic skills; high dropout rates, absenteeism, academic failure, drug abuse, vandalism, and assaults on administrators, teachers, and pupils signal their discontent.

It is a rare school that equips all its students to make the choice upon graduation of entering the job market with a salable skill or of continuing their education. Too often the graduate has neither option, let alone the opportunity to select one or the other.

Nearly 2.5 million students leave the formal education system of the United States each year without adequate preparation for a career. In 1970, not counting enrollment in homemaking, only about one high school student in six was enrolled in occupational preparation. More persons are graduating from a 4-year college with a bachelor's degree than there are jobs for degree holders. By the end of this decade eight out of ten jobs in America will not require a baccaluareate degree.

In a modern society, formal education stands directly between a person and his ability to support himself and his family. If the quality or the appropriateness of any child's formal education is poor, what might have been a roadway to opportunity will remain a barrier. To fail to fulfill a responsibility in this respect means to render a large proportion of the future citizens of this country economically obsolete.

More appropriate curriculums must be developed, validated, and installed and they must be used more realistically if we are to meet the needs and desires of students and serve the purposes of society.

Taken from

Career Education
S. P. Marland, Jr., Commissioner
DHEW Publication No. (OE) 72-39
1971

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To develop self-awareness of personal characteristics.

SPECIFIC BEHAVIORAL OBJECTIVE: The students will be able to demonstrate their knowledge of the development of personal characteristics by charting the development of one personal characteristic.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY

Have students observe their ancestry as far back as possible eg. parents, grand parents, great grandparents, etc. for hair color, eye color, wavy or straight hair, crooked or straight little finger, nose shape, taster (ptc) or non-taster. Study Mendal's work with the pea plant for student understanding. Have students set up charts for a single characteristic and find the offspring possibilities. After using one trait use two, etc.

SUGGESTED TECHNIQUE

1. Students observe and question parents about their characteristics and their ancestors' characteristics .

2. Have students bring pictures of family for comparisons of characteristics.

3. Prepare chart of single characteristics eg. eye color of parents (BB, Bd)

♀

XXX	B	B
B	BBpure	BBpure
b	B b hybrid	b b hybrid

♂ BB
♀ Bb

4. Next you may add a characteristic eg. eye color and finger shape

Continued

RESOURCE MATERIALS

Pictures
SRA Career information Kit
Biology texts
Genetics texts

Film
The Thread of Life
Bell Telephone- free

Transparencies

DNA: A Key to All Life

Filmstrip - Time/Life Series

Resource persons
Doctor, Geneticist, plant breeder

SUGGESTED CORRELATION FOR THIS ACTIVITY: Use when studying genetics.

CONTINUATION ACTIVITY SHEET

ACTIVITY

SUGGESTED TECHNIQUE

♂

♀	Bc	Bc	bc	bc
bc	BbCc	BbCc	bbCc	bbCc
bc	Bbcc	Bbcc	bbcc	bbcc
bc	bBCc	bBCc	bbCc	bbCc
bc	bBcc	bBcc	bbcc	bbcc

4. After this activity bring out the many areas of work that may be involved with genetics - eg. geneticist, plant breeders farmers - animal breeding biologists.

RESOURCE MATERIALS

♀ bbCc

blueeye

hybrid crooked finger

♂ Bbcc

hybrid brown, straight finger

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, each student will be able to list five occupations related to the study of nutrition.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Use two animals e.g. hamsters, gerbels, guinea pigs, rats, mice etc. Place one animal per cage. In the control age feed a balanced diet as advised by a reliable source. In the other cage remove foods containing a particular nutrient e.g. vitamin "A", calcium. Compare animals after an alloted time period.	1. Study dietary needs of the test animals. 2. Establish a balanced diet for one animal (control). 3. Remove foods containing the particular nutrient to be tested from the other animal. 4. Place animals in two cages. 5. Record feedings and any visible changes as the experiement progresses. 6. After a given period of time (to be determined by instructor and students) check animals for comparisons as to eg. coat luster, activeness, eye clarity, general vitality, strength, reactions, temperment, weight, size, areas affected, any noticeable pain areas, etc. (continued)	Animals, cages, nutrients Resource people Pet shop operator county agent dietician doctor Resource material Biology texts SRA Guidance Series Finney's Occupational Guidance kit Food The Yearbook of Agriculture 1959 U. S. D. A.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	7. After making the above comparative examination of the animals, place both on the same balanced diet and record carefully the return to normal of the test animal. 8. Draw and carefully discuss the conclusions. 9. Discuss the many people involved in this type of work eg. Doctor Nurse Dietician Nutritional research Biologist Chemical companies Chemists etc.	

CAREER DEVELOPMEN ACTIVITIES

BROAD OBJECTIVE: To acquaint students with the type and usefulness of a biologist's work.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will orally identify and explain a tool used by a biologist in his work.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In introducing the microscope and identifying its various parts, center a discussion around the various uses of the microscope and how it might be used in a variety of occupations.	1. Introduce the microscope, ask what it is and where it is used. 2. Ask students to describe a biologist in terms of the type of work he does and how this work is useful (as they see it). 3. Have students bring pond water, grow protozoa and prepare slides illustrating what they see. 4. Ask "Is this part of a biologist's work and what value is it?" 5. Have students find what a biologist really does, where he works, the demand for biologists in the future and what background they will need to be a biologist. 6. Identify other occupations that are related to the occupation of biologist. 7. Discuss occupations which use the microscope as a tool.	Microscope Pond water Slides Finney's Occupational Guidance Kit Health Careers kit Careers, Inc.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	8. Let students grow bacteria and identify it to help them understand what microbiology is. 9. Ask students to relate what they think a microbiologist does.	

CAREER DEVELOPMEN ACTIVITIES

BROAD OBJECTIVE: To acquaint students with the biological field and some related areas of work.

SPECIFIC BEHAVIORAL OBJECTIVE: After having studied the biological fields of entomology, ecology and microbiology, each student will list, in writing, at least five duties involved within each field.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In the study of life science, through experiments, show students the work and importance of three different, but related, occupational areas: entomology, ecology, and microbiology.	1. Display several kinds of insects and let them identify and classify them. 2. Talk about the field of entomology and what an entomologist does. 3. Ask students how the field of entomology relates to ecology. 4. Talk about ecology, what an ecologist does, and why they will be so important to the future.	Insects Encyclopedia Any film or filmstrip on Ecology Microscope Pictures of healthy and polluted environments Finney's Occupational Guidance kit Occupational Outlook Handbook Dictionary of Occupational Titles

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMEN ACTIVITIES

BROAD OBJECTIVE: To have students investigate occupations that relate to life science.

SPECIFIC BEHAVIORAL OBJECTIVE: After having brought an object to class and having explained how the object is related to life science, each student will name at least one occupation which involves that object.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In discussing objects that are related to life science students will become aware of the many occupations that apply to a knowledge of life science.	1. Have students bring any object that relates to life science such as pictures, models, rocks, and fish. 2. In a show and tell setting have students give a short description of what it is, where it is found, and what it is used for. 3. After each presentation to the class, the teacher starts a discussion that leads the class to naming occupations involved with the topic.	Any objects relating to life science Booklet: "Jobs in Science" SRA Job Family series

SUGGESTED CORRELATION FOR THIS ACTIVITY:

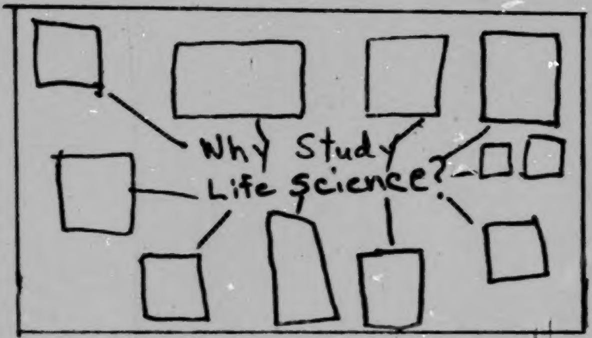
CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show a relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: The students will show a knowledge of jobs related to life science by constructing a bulletin board showing at least 20 occupations related to life science.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Have students prepare a short report on some job they are interested in. The report should bring out the relationship between life science and the work involved in the report.	1. On the center of the bulletin board place the board title "Why Study Life Science". 2. As students report have them bring pictures relating to their job. Run yarn or some type of strip from title to picture. 	Pictures Yarn Colored paper.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To have students investigate relationships between various occupations and the study of life science.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, each student will list his father's or mother's occupation and its relationship to life science.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Discuss the occupations of parents and their relationship to the field of life science.	1. Have the students interview their parents or guardian as to their occupation. 2. Write up an interview sheet to be used by the student. 3. Have those students participating in the interview assignment report on their parents occupation. 4. After reports are completed carry on a class discussion concerning the job and its relationship to life science.	Students, parents and guardians Finney's Occupational Guidance Kit Finney Company, 3350 Gorham Ave. Minneapolis, Minn. 55426 Health Careers kit Careers, Inc.

SUGGESTED CORRELATION FOR THIS ACTIVITY: Can be used as an introduction of life science.

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show a relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, the student will be able to list five occupations related to the growth and germination of a seed.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Plant a bean seed in prepared soil. Optional: Set up a home movie camera and lights to photograph the growth of the seed.	1. Prepare a good humus soil - (learning soil fertility and how one might prepare your own fertilizer - compost heap) 2. Place soil in a clear cake or bread pan. 3. Place seed close to the outer edge of pan. 4. Photograph every 4-6 hours for time lapse sequence. 5. Instead of soil one might use moist blotter paper. 6. Bring out relationship of photography and other fields.	Bean seeds - clear pan - movie camera and lights (opt), soil Books: Our Soils and Their Management by Donahue, Interstate Pub. County Agent Finney Occupational Guidance Kit SRA Career Information kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show the relationship of school subjects to occupational fields.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will be able to list three ways the study of a flower relates to occupations.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Obtain a perfect flower such as a lily or tulip and examine the flower parts.	1. Obtain perfect flowers. 2. By using a hand lens, tweezer and razor blade, pick out the flower reproductive parts and examine the pollin, the stigma, style, stamen, etc. 3. Explain how fertilization takes place and the part insects, wind, etc; play in fertilizing. 4. Go into the work of horticulturists botanist, plant scientist, research biologist and their work in developing new plants.	Perfect flowers, hand lens, tweezers razor blades Pamphlets from County Agent suitable to your plants. Any Biology text. Finney Occupational Guidance Kit Encyclopedia Britannica film Flowers and Bees

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: Gain direct contact with work in their field of interest.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will relate, orally or in writing, at least one reason why he would or would not make his "farm out" activity his career choice.

SUGGESTED SUBJECT AREA Advanced Biology

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Six-weeks "Farm outs" of Advanced Biology students to area facilities.	During a six-week period (starting approximately March 15) the students spend a minimum of 12-15 hours a week observing the area of their interest. 1. Students should be questioned about real interests. 2. "Farm Out" Supervisor should be interviewed to determine the kind of activity the student would be involved in. 3. Fit the student to the "farm-out".	Clinics, hospitals, doctors, veterinary clinics, State Game and Fish Department, Experiment Station, State Laboratory, State Health Laboratory, psychiatric ward, or any other biological science oriented occupation.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with career opportunities in the unit of plant science.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will be able to describe at least 15 occupations in the field of plant science.

SUGGESTED SUBJECT AREA Plant Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Have students compile a notebook of the different jobs in plant science, listing the jobs that should be included, job description, working conditions, employment potential, and where additional information can be obtained. This information compilation could be the results of individual or group activities.	1. Bring in outside resource personnel from the world of work. 2. Interview various people employed in plant science such as feed and seed salesman, elevator manager, farmer, feedlot manager, nurseryman, turf manager, etc. 3. Field trips 4. Research library materials in classroom, school, and public libraries. 5. Use of educational films, slides, and filmstrips. 6. Collect bulletins from industry, extension service and USDA.	Delorit, Richard, and Ahlgren, Henry L. Crop Production, Englewood Cliffs, N. J., Prentice-Hall, Inc. Current Edition Galston, Arrthur W., The Life of the Green Plant, Englewood Cliffs, N.J., Prentice Hall, Inc., Current Edition Martin, John H. & Leonard, Warren, Principles of Field Crop Production, New York, MacMillan, Co. Pearson, Lorentz C., Principles of Agronomy, New York, Reinhold Pub. Profiles, Careers in the U. S. Dept. of Agriculture, USDA Office of Personnel Misc. Publication #1070, Washington, DC 1968 Vocational Education and Occupations, U. S. Dept. of HEW, U. S. Government Printing Office, Washington, DC, 1969

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
		Bulletin: Opportunities in the Field of Agriculture, Prepared by State Universities and Land Grant Colleges Resource People: Extension personnel Elevator manager Bank agriculture representative Nurseryman Greenhouse manager Feed salesman ASCS Greenskeeper Credit agencies (FHA, PCA) Turf specialist Other

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To relate that technology and research affects the number and types of jobs.

SPECIFIC BEHAVIORAL OBJECTIVE: At the completion of this activity the students will demonstrate their understanding of the work of pioneer scientists, why their work was important and what fields of work have been opened up because of their research by listing three jobs created by research.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Make a list of several pioneers eg. Leevwenhoek, Koch, Pasteur, Jenner, Lister.	1. Research the men listed. 2. Discuss the work of each man and how the work of one related to and affects the other. 3. What fields have opened up because of their work? 4. What advancements have been made in recent years as a result of these men? 5. How do we benefit because of their original work?	Textbooks of biology Biographies of the specific men Filmstrips eg. "The Life of Lister"

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the student will be able to list five occupations related to the poultry business.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
By using an incubator, place two dozen eggs in it for hatching. On the third, sixth, ninth, twelfth, fourteenth, seventeenth and nineteenth days open eggs and examine the embryo. Place the embryo in clean baby food jars facing the outside for viewing.	1. Study embryology for the basic knowledge. 2. Set up and explain the working of an incubator. 3. Place eggs in incubator and record date, number of eggs, etc. 4. Periodically, carefully open an egg by making small hole in shell and picking shell off with a tweezer. 5. Fill a clean baby food jar with cotton and saturate with a formalin solution. 6. Place extracted embryo toward outer part of jar for viewing. Label jar with date, number of days developed, etc. Mount on a board for displaying. 7. Discuss the work of an embryologist, chicken farmer, research scientist, and chicken sexer.	Biological text Filmstrip on embryology. eg."Life Before Birth" Part I and II Time/Life education filmstrips Two dozen eggs Incubator Tweezers Baby food jars, cotton, formalin Board for mounting Time Life Book: Growth

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to the wide range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will be able to list five occupations related to the study of bone structure.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
By either collecting a skeleton of a decomposed animal or cooking the flesh off of an animal that has just died, have students reconstruct the skeleton by use of glue and thin wire (stove pipe or smaller). Place reproduced skeleton on a display board.	1. Get a general knowledge of the bones joints, types of movement, functions etc. 2. Examine the composition of bone by placing bone in acid to remove calcium therefore leaving it soft. 3. Make a cross-sectional cut of a long bone examining the marrow cavity, the spongy bone layer, the hard bone layer and the periosteum if present. 4. Observe the foramen openings in the bone and get a general knowledge of their functions. 5. Study the value of good bone making foods eg. milk, vitamin D, etc. 6. Point out deficiency diseases e.g. rickets. (continued)	Film: "Human Body: the Skeleton" University of Illinois Books: Physiology book Anatomy book Biology texts The Human Body in Health and Disease Lippincott Food for Us All, USDA 1969 Resource people: doctor nurse veterinarian dietician county agent

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	7. After this general background have students reconstruct the entire skeleton.	
	8. Have students make comparisons between the animal skeleton being constructed and the human skeleton.	
	9. Go into the broad group of fields involved with this type of activity eg - Doctor Nurse X-ray technician Chiropractor Nutritionist Ambulance Drivers Firemen Policemen Physical Education instructor Animal nutritionalist 1 - bone use for food sources	

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the student will be able to list six occupations related to the distribution of plant seeds.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Have students examine many different plant types and draw conclusions as to how the seed is carried to other areas. Next have students check their conclusions with an authority such as a biology text. A spring and fall activity	1. Students examine local plants eg. dandelion, tulip, iris, pine tree, poplar tree, elm, buckwheat, wild oats, etc. 2. In the fall have students who enjoy hunting upland game bring in the crops and intestines of game birds and check the many types of seeds present. Discuss all methods of transportation and jobs related e.g. wildlife biologist, game warden, farmer, gardener, botonist, herbicide, plant research, chemist, etc.	Plants and seeds, hand lens, biology texts, disecting kit to open crops Pamphlets on weeds and seeds Distribution in county agents office. Wildlife biologist SRA Career Information kit Finney Occupational Guidance Kit. Resource people: Vocational Agriculture

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To learn the work of a gardener, and become aware of growing plants.

SPECIFIC BEHAVIORAL OBJECTIVE: The students, after completion of this activity, will be able to list at least three responsibilities of the gardener.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Plant an exterior or interior garden depending on time of year.	Prepare soil- 1. become aware of humus 2. understand mulching 3. learn soil types, origins and fertility for various plants. Prepare window box (if inside) Students can build a 1' X 6' X 1' box for the interior garden. Select suitable seeds - check germination etc. Water, weed, care for and eat. Discuss fields related to activity, eg. gardener, botonist, horticulturist, plant scientist.	Book Raising Vegetables by Ware and McCallum Interstate Pub. Soils and their Management by Donahue. Interstate Pub. Soils by Donahue Prentice Hall Pamphlets from County Agent Resource people - local county agent, local greenhouse, parent gardener, Vocational Agriculture person. Seeds of your choice

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, the students will be able to list five occupations that use beneficial bacteria.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Take a field trip to a local creamery or cheese making plant, studying the process of cheese making and how it is related to the field of bacteriology and other related occupations.	1. Prepare students by studying bacteria prior to field trip. 2. Point out things the students should look for and questions that could be asked when touring the creamery. 3. After returning from the trip discuss the many jobs related to the cheese making business eg. farming, dairying, and bacteriology.	Cheese making plant or creamery Bacteriology text Biology text County agent Agricultural service pamphelts on cheese-making Bus or parent transportation Finney Occupational Guidance Kit SRA Career information Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY: Can be used when studying bacteria.

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will be able to list five beneficial bacteria and an occupation related to each.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY

List a large group of bacteria names for the students to use. Have students list the bacteria according to beneficial and harmful affects, next have the student list the affect of each bacteria and end activity with a discussion of occupations involved.

SUGGESTED TECHNIQUE

Harmful causes	Beneficial causes
Cholera	Decomposers
Dystentery	Tanning leather
Tuberculosis	Softening Leather
Syphilis	Making linen
Tetanus	Making cheese
Pnemonia	Curing tobacco
Bubonic plague	Aid healing
House rotting	Fixing nitrogen

Discuss the numerous job opportunities available because of the above mentioned bacterial affects.

Jobs related: Bacteriologist, tanner, tobacco producer, medicine, etc.

RESOURCE MATERIALS

Biology texts
Bacteriology text
Filmstrips on bacteria
Microviewer - Bacteria Slide

Resource possibilities:
Plant pathologist
Soils
County agent
Doctor
Nurse
Lab. Tech.
Creamery worker
Tanner
Farmer

Finney Occupational Guidance Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, the students will be able to list a job related to each beneficial and harmful protist listed.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In three columns, have students list several protists, the beneficial and harmful aspects of each protist and the jobs related to each group.	Prepare a column of beneficial and/or harmful protists. Prepare another column listing the affects of the protist. Prepare a third column with a list of jobs resulting because of the protist. Harmful Affect Jobs Plasmodium Malaria Swamp drainage Medical Control education Chemist (insecticides) Beneficial Affect Jobs Amoeba Food chain-Fishery biologist Marine biology cologist Local pond water can be used to show many protists.	Filmstrip on pond life or protozoa Movies - " onds" - U. of Ill. Biology Texts Encyclopedia Microviewers and slides on protists Resource people - Medical missionary Local doctor Service men who observed malaria problems. Finney Occupational Guidance Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose the students to the work of a lab technician.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the student will be able to explain in writing the work of a lab technician.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Remove a small amount of epithelial tissue from the inner cheek region, stain it, observe it under a microscope and learn the main parts of it eg. cytoplasm, nucleus, cell membrane cell shape, etc. Do the same with the cells from an onion -have students note the difference in the cell membrane and the cell wall found in the plant cell.	1. Have students scrape the inner lining of the cheek with a toothpick. 2. The saliva on the toothpick usually contains epithelial tissue. 3. Place a drop of H_2O on a blank slide and place the scrapings in it- carefully move the tissue around to aid in flattening it. 4. Place a small amount of iodine on the slide for staining purposes. 5. Place a cover slip over the tissue and place under the microscope. 6. Have students observe slide, draw and label the parts. 7. Follow the same procedure as with the cheek cell and prepare a slide of onion skin cells.	Biology texts SRA Guidance Series Finney Occupational Kits Resource people Doctor Nurse Lab. tech Plant pathologist Physiologist Materials needed: microscope tweezers, iodine, cover slips slides, toothpicks, eye dropper, and drawing paper.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	8. Have students extract some thin membrane from a common onion, stain it, draw and label it. 9. Discuss some likenesses and differences between plant and animal cells. 10. Bring [illegible] the many jobs related to the use of a microscope the study of plant and animal cells eg. Microbiology Biology Doctors Nurses Technicians Plant pathologists Bacteriology Physiology	

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, the student will be able to list five occupations related to the study of soils.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
To collect one square foot of soil and determine its composition as related to living and non-living things.	1. Have the students bring in a cut of soil 1' x 1' x 1' (keep soil in tact as cut from ground). 2. Have students draw and label the soil cross section as to color, texture, root depths, humus depth, etc. 3. Next, have students remove layers approximately 1" deep and separate it with a sieve or sifters of various sized openings. 4. Record from each layer (top 1" - 1st layer, etc.) the organisms, pieces of any type of mulch, insects. 5. When finished discuss the various soil samples, where they come from and if known by the student, the fertility in regards to growing things e.g. garden, wheat, grass, etc. 6. Discuss the people normally involved with this type of activity e.g. soil scientists, county agent, geologist, paleontologist, farmer, gardener, fertilizer salesman, researcher.	Spade Screens (different sizes) Small gardening shovel Hand lens Collecting sacks (insects, etc.) Texts: Profitable Soil Management Prentice Hall Soils, Prentice Hall Approved Practices in Soil Conservation, Interstate County agent Soils filmstrips

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to the wide range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the student will be able to list five occupations related to soil conservation.

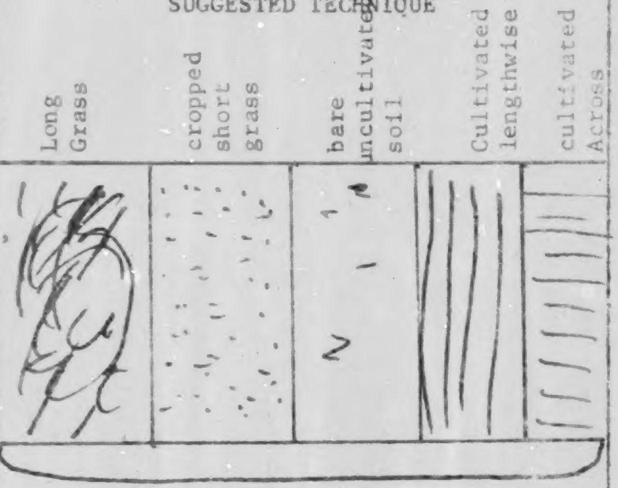
SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY

By using a large shallow tray or several smaller trays, place a strip of sod covered with thick long grass, a strip of sod which has been closely cropped (right to the soil level), a strip of bare uncultivated soil, two strips of bare cultivated soil (two different directions of cultivation). Place these trays at a slight angle and using a water sprinkling can pour equal amounts of H_2O on each sample. After the water flow has stopped observe things eg. amount of soil carried away, ditches washed out of soil, depth of moisture into the soil. Next weigh the dry run off soil and calculate the percentage differences between the different soil coverings.

SUGGESTED TECHNIQUE



Discuss the many jobs connected with the soils. eg. farming, soil research, gardening, county agent, implement dealer farm practice research, soil management, cattle raising, ecologist, graminologist, agronomist, irrigation.

RESOURCE MATERIALS

trays
sprinkler can
soils
scale
scissors

Books:
Planning for an Irrigation System
AAVIM
Our Soils and Their Management by
Donahue
Conservation, AASA

Profitable Soil Management
by Knuti, Karpi, Hide

Soils by Donahue

Approved Practices in Soil Conservation
by Foster
County agent booklets.
Resource people - county agent, local farmer and rancher, machinery dealer.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with career opportunities in the unit of Soil Science.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will be able to describe at least ten occupations directly involved in the field of Soil Science.

SUGGESTED SUBJECT AREA Soil Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

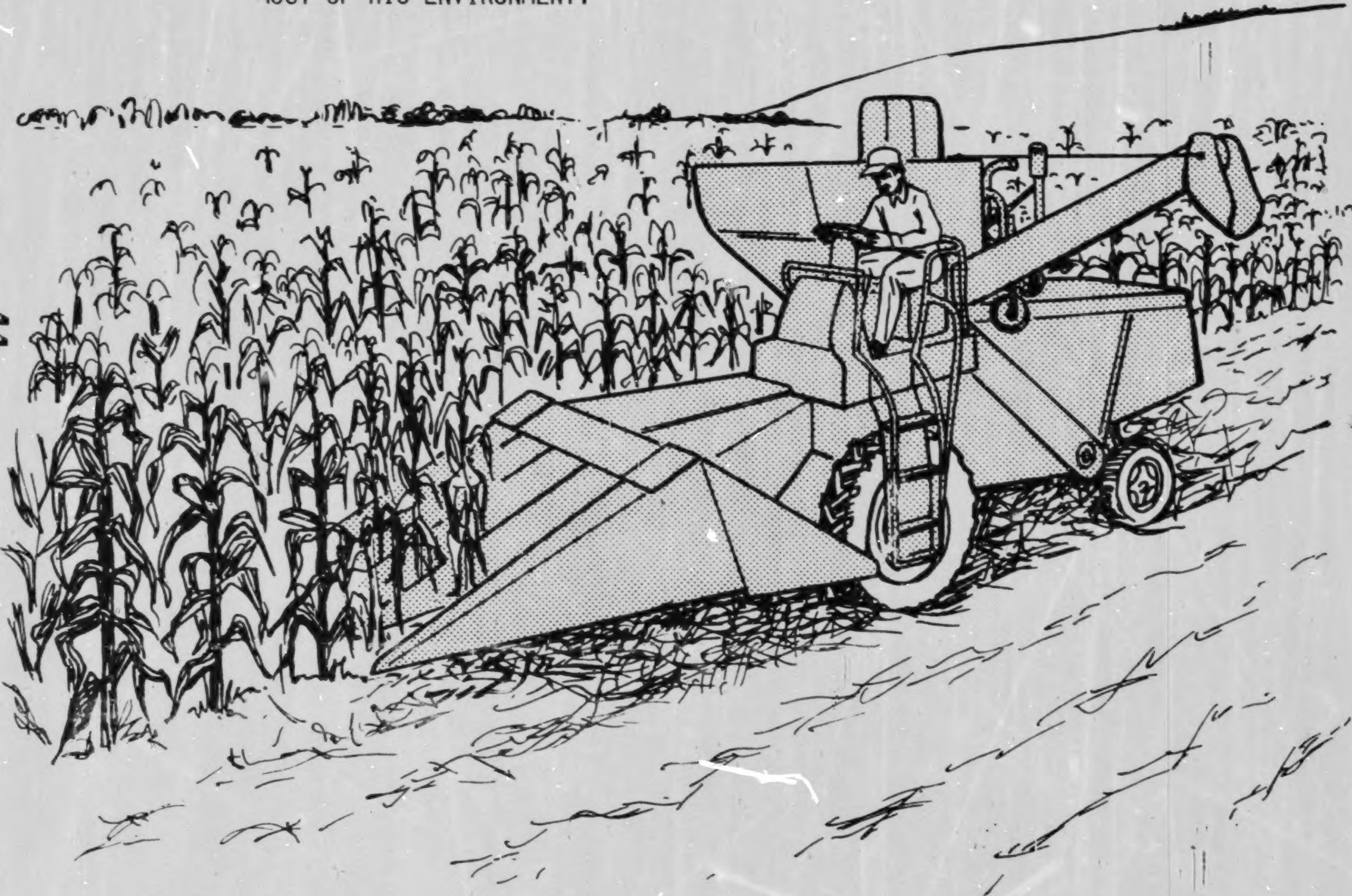
ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Have students compile a notebook of the different jobs in soil science. Listing of jobs should include job description, working conditions, educational requirements, employment potential and where additional information can be obtained.	1. Field trips to community 2. Interview resource people on the job. (SCS, fertilizer and chemical salesman, fertilizer truck operator, etc.) 3. Guest speakers 4. Department resource materials, school and city library reserves. 5. Use of educational films, filmstrips, and slides. 6. Collecting of material from USDA, extension service and private industry.	Hoover, Norman K. Handbook of Agricultural Occupations, 2nd Edition, Danville, Ill., The Interstate Printers and Pub., 1969 Donahue, Roy L. Our Soils and Their Management, Danville, Ill., Interstate Printers, 1970 Knute, Korpi, & Hide, Profitable Soil Management, Englewood Cliffs, NJ., Prentice Hall, 1962 Profiles, Careers in the U.S. Dept. of Agriculture, USDA Office of Personnel Misc., Publication #1070, Washington, DC 1968 Vocational Education and Occupations, U. S. Dept. of HEW, U. S. Government Printing Office, Washington, DC 1969 Bulletin: Opportunities in the Field of Agriculture, Prepared by State Univ., Land Grant Colleges, high school students & counselors in 14 states.

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
		Resource People: SCS personnel fertilizer plant manager fertilizer truck driver fertilizer salesman fertilizer production employee greenhouse manager landscape architect soil scientist bank agriculture representatives county agents others

THE AGRICULTURAL ECONOMIST, SOIL CONSERVATIONIST, ENVIRONMENTAL SCIENTIST, AND MANY OTHERS HAVE HELPED THIS FARMER TO MAKE THE MOST OF HIS ENVIRONMENT.



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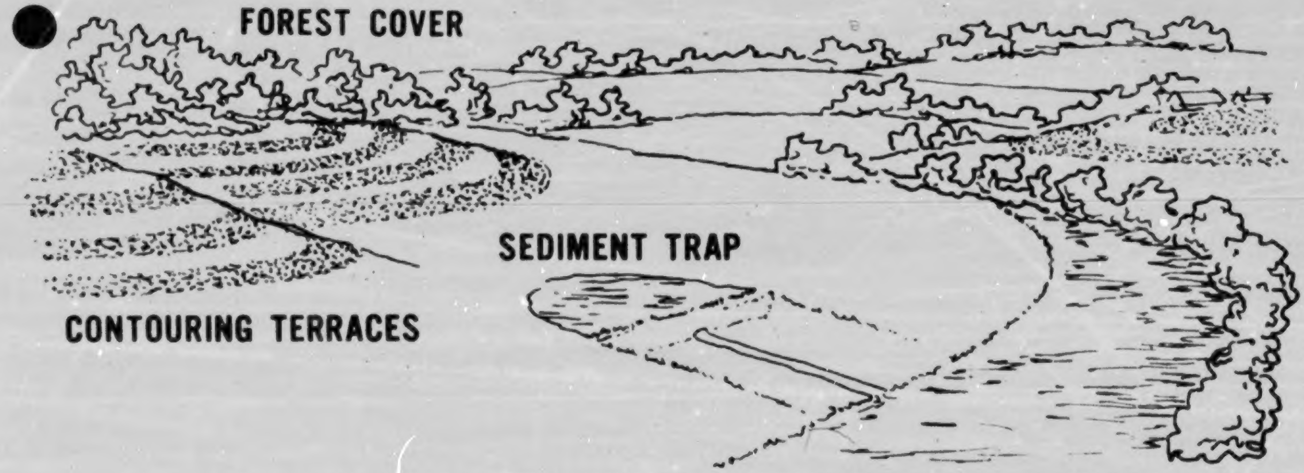
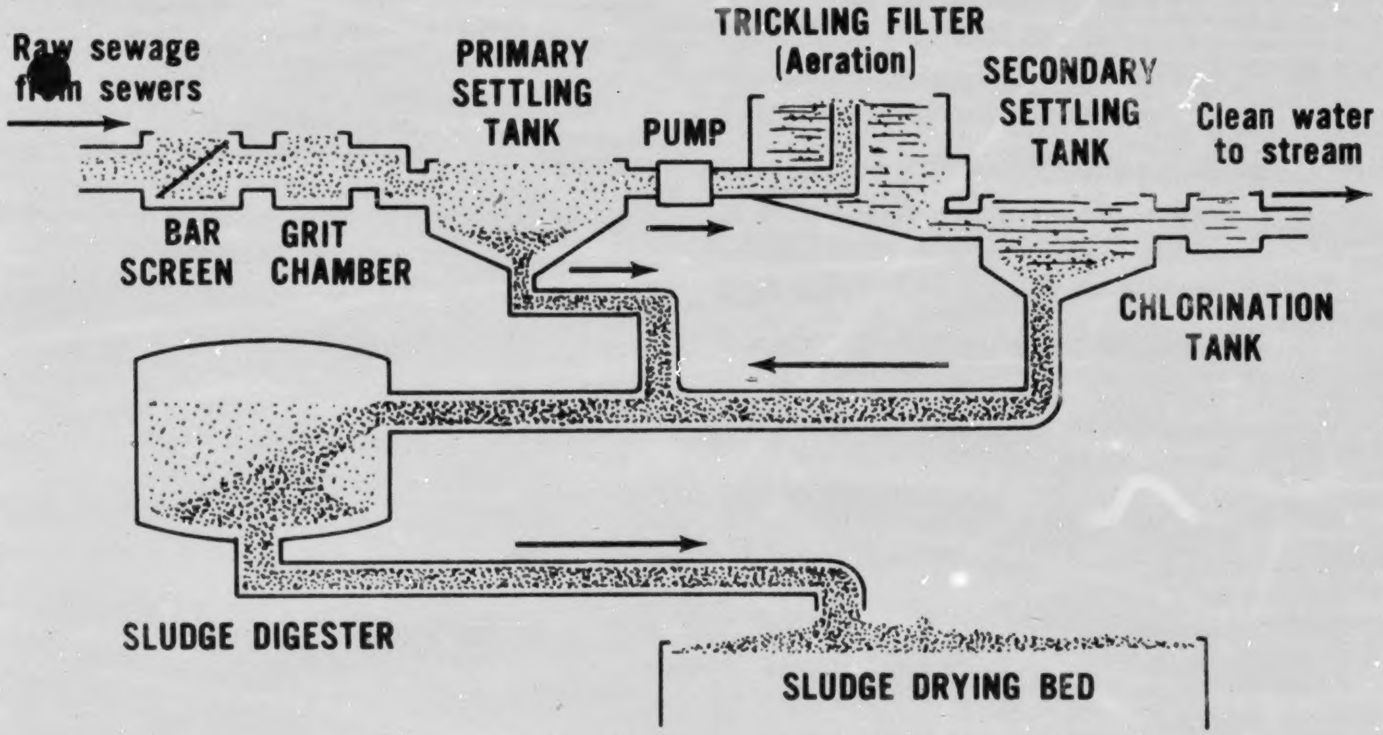
HELPING TO PREVENT POLLUTION


FOREST COVER
SEDIMENT TRAP
CONTOURING TERRACES

SEDIMENT IS THE MAJOR POLLUTANT IN STREAMS AND RIVERS THROUGHOUT THE UNITED STATES. PROPER LAND TREATMENT GREATLY REDUCES THE AMOUNT OF SEDIMENT ENTERING STREAMS.


Raw sewage from sewers
BAR SCREEN
GRIT CHAMBER
PRIMARY SETTLING TANK
PUMP
TRICKLING FILTER (Aeration)
SECONDARY SETTLING TANK
Clean water to stream
CHLORINATION TANK
SLUDGE DIGESTER
SLUDGE DRYING BED

MUNICIPAL SEWAGE TREATMENT PLANT

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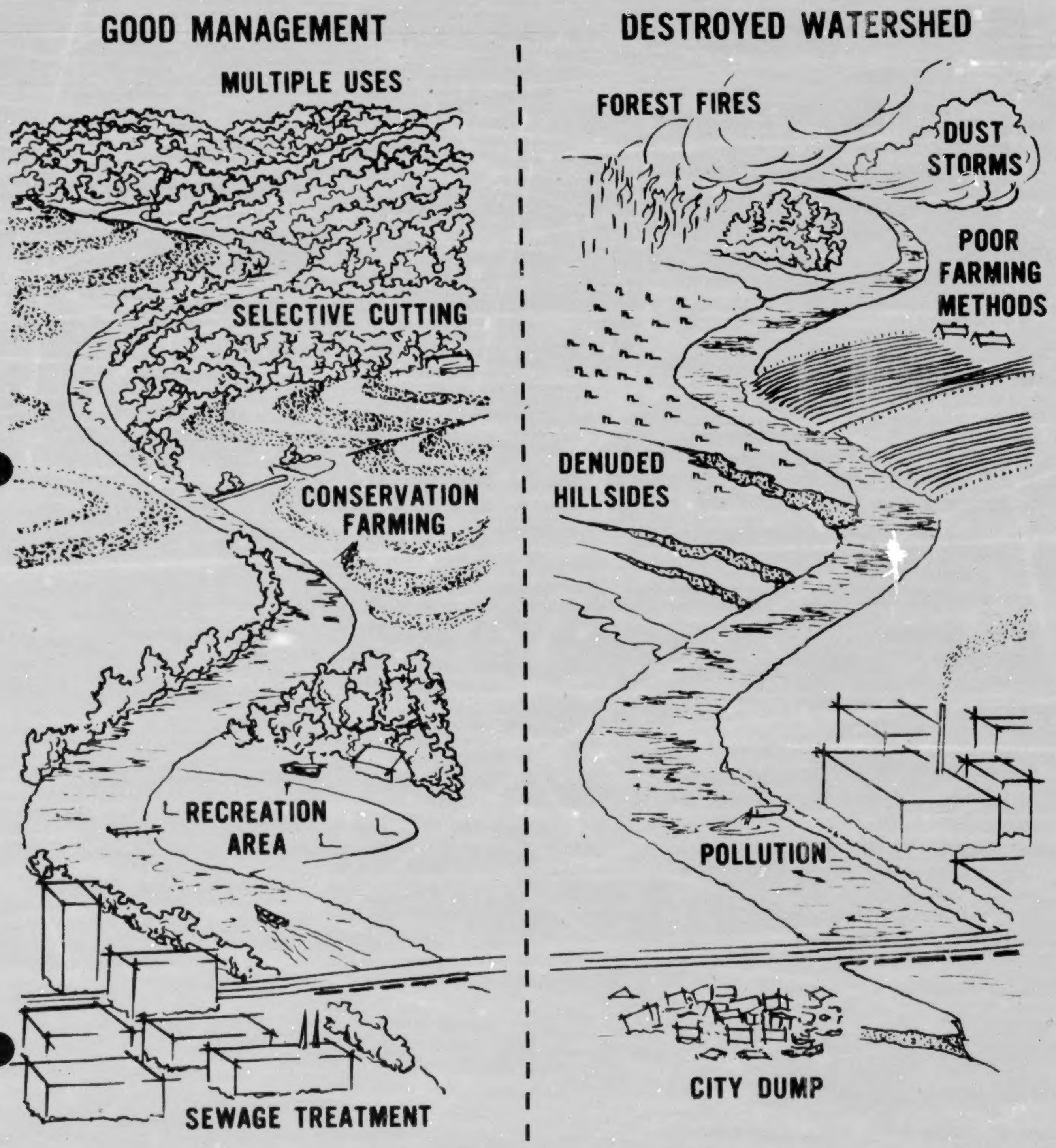
WE HAVE THE POWER TO CONSERVE - - - OR DESTROY


GOOD MANAGEMENT
MULTIPLE USES
SELECTIVE CUTTING
CONSERVATION FARMING
RECREATION AREA
SEWAGE TREATMENT
DESTROYED WATERSHED
FOREST FIRES
DUST STORMS
POOR FARMING METHODS
DENUDED HILLSIDES
POLLUTION
CITY DUMP

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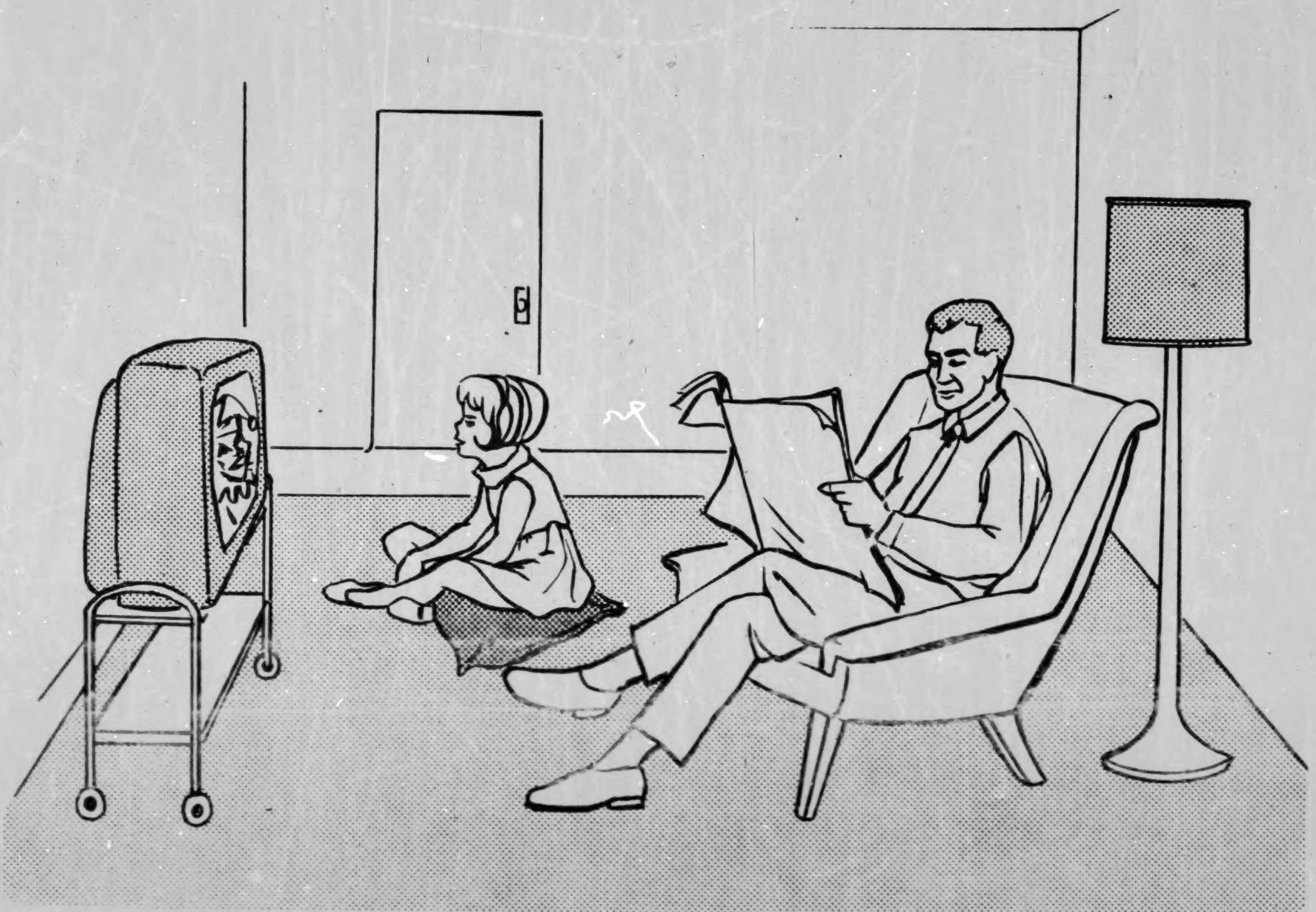
MODERN MAN NO LONGER DEPENDS ON THE RESOURCES OF HIS IMMEDIATE ENVIRONMENT



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CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a wide range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will be able to list five occupations related to the study of mollusks and marine life.

SUGGESTED SUBJECT AREA Life Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Collect several bivalves from local sources eg. streams, ponds etc. Have students bring bivalve shells which have been collected in travels. Study the bivalve parts, their monetary value, food value, ecological value, labor market value, etc. Relate this animal type to the many jobs open which relate to the animal.	1. Collect a variety of living bivalves from streams ponds, etc. 2. Place bivalve in a pail of clean H_2O containing some oatmeal to clean sand from body organs. 3. Disect bivalve, studying all parts and functions. 4. Students may take the foot, tenderize and prepare it for eating. 5. Examine the valves of things such as collected oyster shells bringing out the various jobs related to the animal eg. cultured pearls commercial oyster raising marine biologist pollution control ecologist jeweler dietician	SRA Career Information Kit Finney Occupational Guidance Bivalves Dissecting kit Fresh H_2O and oatmeal Filmstrips on mollusks Biology texts

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMEN ACTIVITIES

BROAD OBJECTIVE: To make students more aware of the supply of, and the demand for, service related occupations.

SPECIFIC BEHAVIORAL OBJECTIVE: After having selected a science related occupation in which he would like to work, each student will demonstrate a knowledge of the projected need for science related occupations by listing at least three geographic locations, the educational requirements, salary and projected need for his chosen occupation.

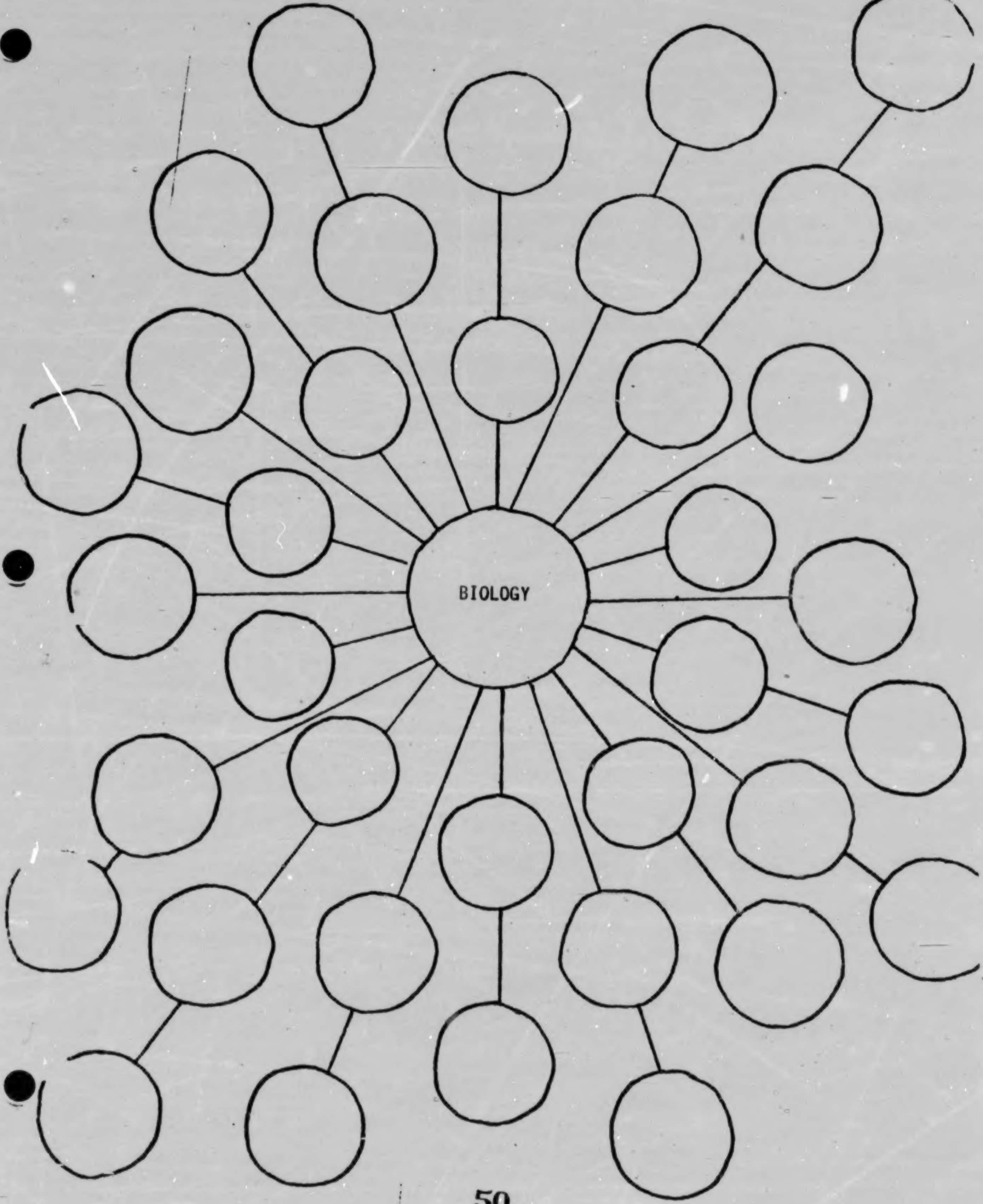
SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

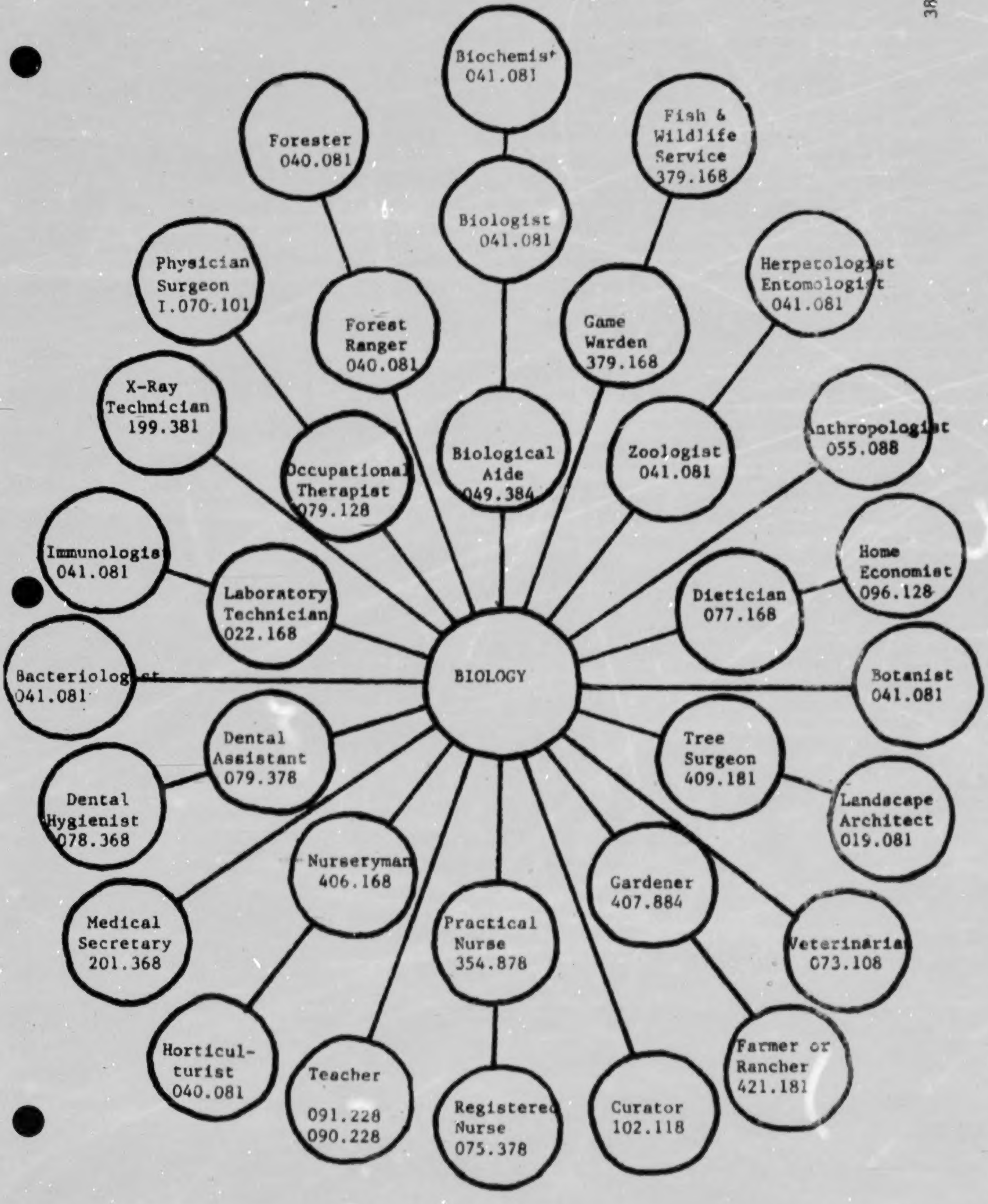
ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Using the enclosed cluster sheets depicting various occupations in the life science area, students should become aware of a wide range of science related occupations and what the future of the occupations are.	1. Have students write an article about a science related occupation they would like to do for their life's work. 2. Without reference have them tell where they would like to live, what they think the educational requirements might be, how much they will earn, and "guess" how much demand there is for their chosen occupation. 3. By consulting occupational sources have students fill in as many science related occupations as they can on the blank cluster sheet. 4. Have students list the geographic areas of their occupations, educational requirements, salary and most important, have them report to the class on what the "projected need" is for that occupation. 5. Have them compare this information with their articles to see how realistic their analysis was.	Dictionary of Occupational Titles Occupational Outlook Handbook Finney's Occupational Guideance Kit Magazines Newspapers Booklet: "What Good Is Science?" SRA Guidance Series

SUGGESTED CORRELATION FOR THIS ACTIVITY:

SOME OCCUPATIONS RELATED TO INTEREST AND ABILITY IN BIOLOGY



SOME OCCUPATIONS RELATED TO INTEREST AND ABILITY IN BIOLOGY


Biochemist 041.081
Forester 040.081
Fish & Wildlife Service 379.168
Biologist 041.081
Physician Surgeon I.070.101
Forest Ranger 040.081
Game Warden 379.168
Herpetologist Entomologist 041.081
X-Ray Technician 199.381
Occupational Therapist 079.128
Biological Aide 049.384
Zoologist 041.081
Anthropologist 055.088
Immunologist 041.081
Laboratory Technician 022.168
Dietician 077.168
Home Economist 096.128
Bacteriologist 041.081
BIOLOGY
Botanist 041.081
Dental Assistant 079.378
Tree Surgeon 409.181
Dental Hygienist 078.368
Landscape Architect 019.081
Nurseryman 406.168
Gardener 407.884
Medical Secretary 201.368
Practical Nurse 354.878
Veterinarian 073.108
Horticulturist 040.081
Teacher 091.228 090.228
Registered Nurse 075.378
Curator 102.118
Farmer or Rancher 421.181

CAREER DEVELOPMEN ACTIVITIES

BROAD OBJECTIVE: To acquaint students with the effects of man's inventions on the world of work.

SPECIFIC BEHAVIORAL OBJECTIVE: To demonstrate a knowledge of how one man's discoveries and research affected the number and types of jobs, each student will list at least seven jobs created by Alexander Graham Bell's inventions.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Find out what Alexander Graham Bell contributed to science and the world of work by showing a movie, discussing the movie, handing out prepared booklets and inviting a speaker from Northwestern Bell to the class.	1. Introduce the unit on Bell by showing the film "Here Is Tomorrow." 2. Discuss the movie and ask them to list as many jobs as possible that Bell was responsible for. 3. Hand out booklets that are listed in "Resource Materials" section and let students investigate the telephone industry. 4. Invite guest speaker using resource person guideline in appendix. 5. Ask students to list as many jobs as possible that were created by invention of the telephone.	Film: "Here Is Tomorrow" FREE Northwestern Bell Telephone Co. Speaker: Bell Telephone Co. Booklets: "Electronic Switching" "Satellite Communications" "The Telephone at Your Command" "How the Phone Works" "Laser, the New Light" "Machine Talk" "The Magic Crystal" "The Telephone in America" "Signals in Space" All free from N. W. Bell SRA Guidance Series booklets: "Understanding Our Economy" #5-834 "Exploring the World of Jobs" #5-1082

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: Acquaint students with science related occupations.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will relate orally how his participation in at least three of the named clubs could lead to a different occupation.

SUGGESTED SUBJECT AREA Science or Science clubs

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Becoming acquainted with club activities and their possible relationship to an interest in an occupation.	Show how interests and hobbies can lead to an occupation by:	Local occupational specialists (i.e. photographers, engineers)
	a. using local occupational specialists to talk to students	Clubs:
	b. going on field trips to local job facilities	Photography Science JETS (Junior Engineering & Technical Society)
	c. visit clubs listed in resource column.	Medical Careers
		Engineering Post (MDU sponsored)

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with the work of an archeologist.

SPECIFIC BEHAVIORAL OBJECTIVE: After studying the earth and its formations, each student will write a descriptive paragraph on the work of an archeologist including those points listed in item three of suggested technique.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In studying the nature of the earth and how it has changed, let students investigate the work that people do in studying the earth and its formation.	1. Following the study of the earth and its formation, ask students to name occupations that involve this kind of work. 2. Ask students how many have heard of archeologists and if they know specifically what they do. 3. Using the occupational sources, have students write a brief paragraph including: a) nature of the work b) training required c) future outlook d) estimated salary 4. Have students conclude the paragraph by stating why they think this work is important.	Films: The Fossil Story Story in the Rocks Shell Oil Company The World is Born Walt Disney Films Finney's Occupational Guidance Kit Occupational Outlook Handbook

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To have students acquire a knowledge of the work of a geologist.

SPECIFIC BEHAVIORAL OBJECTIVE: Following a discussion of the geological field, each group of students will give a three minute report to the class on the work of a geologist and related occupations.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
While studying rocks and rock formation students should become aware of geology and related areas.	1. Before starting the unit on rocks and rock formation, ask each student to write a paragraph explaining what they think a geologist does. 2. Following the unit, ask students if their ideas have changed. 3. Divide students into groups and assign each group the task of finding information on the specifics of a geologist's work and list as many related occupations as they can. 4. Each group should report to the class on their findings.	Finney's Occupational Guidance Kit Occupational Outlook Handbook Any other occupational sources

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with astronomy and related areas.

SPECIFIC BEHAVIORAL OBJECTIVE: Following the study of astronomy and related areas, each student will list five specifics of the work of an astronomer.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
While investigating the field of astronomy, be sure that students, through their own investigation, become aware of astronomy and related areas.	1. Introduce unit by listing and explaining various kinds of viewing equipment. 2. Discuss astronomical terminology such as variable stars, selenography, spiral galaxies, etc. 3. Ask students, "What field of work uses this knowledge?" 4. Have students list at least five specifics of an astronomer's work. 5. A star gazing group will be practical application of the knowledge acquired.	Viewing Equipment Any Earth Science Textbook Occupational Outlook Handbook Any films or filmstrips on Astronomy Finney's Occupational Guidance Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To make students aware of the projected need for various types of scientists and science related occupations.

SPECIFIC BEHAVIORAL OBJECTIVE: After having written an article on a science related occupation, each student will list at least four geographic locations, the educational requirements, salary and "projected need" for his chosen occupation.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Using a cluster approach depicting various occupations in the earth science area, students should become aware of a wide range of science related occupations and what the future of the occupations are.	1. Have students write an article about a science related occupation they would like to do for their life's work. 2. Without reference have them tell where they would like to live, what they think the educational requirements might be, how much they will earn, and "guess" how much demand there is for their chosen occupation. 3. By consulting occupational sources have students list as many science related occupations as they can. 4. Have students list the geographic areas of their occupations, educational requirements, salary and most important have them report to the class on what the "projected need" is for that occupation. 5. Have them compare this information with their articles to see how realistic their analysis was.	Dictionary of Occupational Titles Occupational Outlook Handbook Finneys Occupational Guidance Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: How art can "sell" an abstract idea as well as it can sell merchandise.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will demonstrate the ability to make a two or three dimension model of an atom by constructing one.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Have each student make a 2 and 3 dimensional model of an atom.	1. Let the student use his imagination making them aware that colors, size, materials used, neatness, compactness, ease of assembly, cost, instructional value, and all other criteria that a commercial artist would use will be the "yardstick." Assign a different element to each student. Have each student explain what color represents an electron, neutron, and proton. Have the students then discuss different ways both ideas and merchandise are sold by coloring models, graphs, etc.	Filmstrip: Electron Arrangement and Chemical Bonds 49 frames color (#9973) Encyclopedia Britannica Gamow G Mr. Tompkins Explores the Atom Cambridge University Preso 1955 Atoms, Crystals, Molecules (I and II), American Education Publications, Columbus, Ohio 43216
	2. Relate classifying "things" logically in other sciences clouds, animals, plants, soils, etc.	Chemistry Job Cluster Chart 041.081, 141.081 Physics Job Cluster Chart 017.281

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 3, "Atomic and Molecular Structure"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with oxidation as it applies to firemen, welders, painters and exterior metal workers

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will be able to explain oxidation where it is rapid or slow. The students will be able to discuss prevention of unwanted combustion and way to promote desirable combustion.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Have the students "feel" the heat of oxidation in a pile of lawn trimmings a few hours old by putting your hand in the center of the pile.	1. Use a thermometer and record temperature. Spontaneous combustion of oily rags etc. can be discussed and the role of home safety education.	Asimov, Isaac, Environments Out There-Ablelard Romer Alfred, The Restless Atom Doubleday and Company
2. Have a student report to the class on oxyacetylene welding from information gathered at a local repair shop.	2. If the school has a trades section or a vocational agriculture class the information can be obtained there. The welding trade as applied to industries and agriculture should be mentioned.	Alyea H. , Tested Demonstrations in General Chemistry Journal of Education 19 Physics Job Cluster Chart 373.884, 810,894
3. Spread some lycopodium powder or starch on a metal plate and try to burn it. Notice how difficult it is to get a compact mass of the powder to burn. Now take a pinch of the powder and scatter several feet over a bunsen flame. Notice the flash of flames as the dust particles hit the Bunsen Burner.	3. Relate the demonstration to elevator dust explosions the industries needed to prevent these explosions and role of the firemen. Oxidation of metal surfaces and paints can be discussed as well as all coating industries.	Resource person: Welder

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedl, 1970
Ch. 4, "The Nature of Some Common Gases"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a full range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students in groups of five, will demonstrate the work of a research chemist by growing crystals and using an indicator.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Grow crystals.	1. Grow some "hypo", alum or copper (II) sulfate crystals.	1. Holden, Alan and Singer Phylis Crystals and Crystal Growing, Anchor Doubleday and Co. Forman, Robert, The Science of Salt David McKay Co. J. F. Caska, "Grape Juice an Indicator" Journal of Chemical Education, May 1962 Swezey, Kenneth, After Dinner Science McGraw Hill Book Company. Vander Werf, C. A. Acids Bases and the Chemistry of the Ciralent Board Reinhold Films: Crystals #0113- 25 min- color Modern Learning Aids Crystals and Their Growth (11 min), Color, Coronet Films Inc. Acids, Bases and Salts (2 reels 21 min) Coronet Films Inc. Filmstrip: "Acid and Basic Solution" #9142 about 40 frames color McGraw Hill Chemistry Job Cluster Chart 376.868 054.088 Resource people: Water treatment plant Bacteriologist
2. Use standard indicators	2. Test some foods with wet litmus paper to determine if they have acidic, basic or neutral properties.	
3. Grape juice and purple cabbage	3. Test items with grape juice and purple cabbage indicators.	
4. Determination, whether an unknown is acid, base or salt by use of indicators.	4. A discussion can follow of how important visual indicators are in industries and to a biochemist or bacteriologist or chemist.	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Firedl, 1970 Ch. 5, "Acids, Bases & Salts"

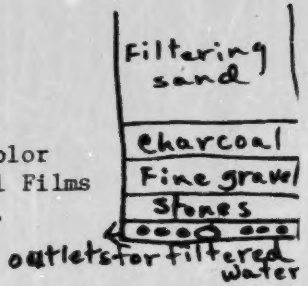
CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with city water supply and treatment systems occupations.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will be able to list five occupations involved in water supply and treatment systems.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Construct a model water filtration plant similar to their city's water plant.	1. If city's water supply is from wells construct a filter similar to diagram. 2. Chlorination and fluoridation of water can be discussed and develop into a discussion of dentistry. Roles of architects, civil engineers, sanitary engineers, meter readers, water chemists, bacterologists should be empasized as the water is traced from the source to the consumer.	 Filtering sand Charcoal Fine gravel Stones outlets for filtered water Film: Water For The Community, 11 min. color Coronet Instructional Films 65 E. South Water St. Chicago Ill 60601 Booklet: Your Future as a Dental Hygienis Paige $3.78 Campbell and Hall Box 350 Boston, Mass. 02117 Chemistry and Physics Job Cluster Charts 008.081, 029.181, 041.081

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 8 "Water and the Chemistry of Its Treatment" pg. 120

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to occupations in the field of pollution.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, each student will list at least four occupations relative to the protection of our environment and the duties of each.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make a report on how radioactive materials are stored and disposed of in a local hospital. What precautions are taken in handling the radioactive materials.	1. Discuss how it can be used to cure but it also can also kill unless trained personnel can handle it.	Kavaler, Lucy Dangerous Air John Day Company Lepkowski, Wilbert C. "Environment" Chemical and Engineering News, March11,
2. Write to the National Center for Air Pollution Control, U. S. Public Health Service, Washington, D.C. 20201 for available material on air and water pollution.	2. After obtaining materials write to your State Health Department and see how your states pollution levels relate to the nation.	Air Pollution Training Program, U. S. Department of Health, Education, and Welfare, Pub. No. 1542, U.S. Government Printing Office Washington, D. C. 20402
3. Find out what local and state laws have been enacted to minimize the effect of air and water pollution.	3. Find out what local ordinances are endorced concerning pollution from your local or district health unit.	Carson, Rachel, Silent Spring Crest Bo Fawcett World Library Asimon, Isaac Chemicals of Life Signet Books
4. Tour of sewage facilities.		"Our Polluted World" American Education Publications, Education Center, Columbu Ohio 43216
5. Speaker from health unit.		
6. Tour of Air pollution and Radiological Health Facility of State Health Department		Battan Louis J. The Unclear Sky Doubleday, Anchor Books.
7. Calculate dustfall.	7. Using a straight wall container collect the dust from just outside the classroom and calculate the dustfall per	Fox, Charles H. Radioactive Wastes U.S. Atomic Energy Commission Box 62 Oak Ridge Tennessee 37830

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 9, "Environmental Pollution"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	unit area. Compare it to health department statistics.	Behrman, A. S..The Chemistry of Water Purification, Doubleday and Co. Films (16 mm) Air Pollution: Take a Deep Deadly Breath (Parts I, II & III) 54 min, Color McGraw Hill The Problem With Water is People 30 min Color McGraw Hill Films R-A-P:. Radiological Assistance Program (26 min) color, consolidated films Industries, 959 seward street, Hollywood California 90038 Chemistry and Physics job Cluster Charts 021.088, 023.081, 025.088

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show a relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will be able to list six occupations related to the study of chemistry.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make paint 2. Make cement and finally concrete.	1. To make a white oil paint, take about 3 or 4 grams of zinc oxide; add linseed oil, a few drops at a time until you have a thick white paste. To about 4-5 ml of linseed oil in another beaker, add about a half gram of manganese dioxide. Let the oil and manganese dioxide come to a boil. After this mixture has cooled for several minutes, filter through a thin nylon cloth. Next add the white paste to the filtered solution and mix thoroughly. Thin with turpentine if necessary. Paint several items and determine the "covering quality" and "sticking quality" of your paint. Lead in a discussion of need for experimenting with coating and methods to apply them. The paint chemist must make a paint to meet certain specifications. 2. Mix powdered clay and limestone and heat till combined. Grind the mixture and combine it with gravel, sand, and water. Prove that the finer the	How to Paint Your Home, National Forrest Products Association, 1619 Massachusett Avenue N. W., Washington D. C. 20036 Physics Job Cluster Chart 022.081 Chemistry " " " 006.081 008.081 022.081 $CaCO_3$ (23 min), color, Gardner Denver Co Quincy, Ill 62302 Concept of Concrete (28 min) Ideal Cement Co, Denver National Building, Denver, Colorado 80202 Glass Science and People, (20 min), Colo Owens - Illinois Glass Co. P. O. Box 103 Toledo, Ohio.

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedl, Copyright 1970, Ch. 11, "Materials for Building"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
3. Make glass.	cement the better the concrete. A ceramic engineer develops methods for processing silicates, clay, and other non-metallic minerals into cement, glassware, brick, and coatings. 3. Using a merck burner melt together limestone, soda ash and sand. See what quality glass you can produce. Add iron oxide, cobalt, chomium, or selenium to make colored glass. Show the students a laboratory glassware product and discuss the role played by a glass blower.	

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To learn about occupations in the foundry.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will make an item from lead, illustrating the need for patternmakers, molders and coremakers.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Obtain a metal from an ore.	1. Heat lead oxide with carbon on an asbestos pad to reduce the ore to lead and make a lead object (make a wheelweight lead sinker, or bullet.)	
	2. Determine physical properties of lead.	Film: The Lead Matrix (27 min) U. S. Bureau of Mines 4800 Forbes Ave. Pittsburg, PA 15213
	3. Discuss chemists role in determining whether it is an ore or not and jobs involved in mining, refining, and manufacturing of lead and lead products. Use of lead, jobs, industries created because of lead can also be discussed.	Booklet: A Job with a Future in The Steel Industry, David $3.59 E. M. Hale and Co. Box B-1473 Minneapolis, Mn 55480 Physics Job Cluster Chart 862.831 010.081

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Friedl, Tracy, Tropp, 1970
Ch. 13, "Mettalurgy of Other Common Metals"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To investigate jobs created by the camera.

SPECIFIC BEHAVIORAL OBJECTIVE: By assuming the roles of a photographer and a photo lab technician, the student will demonstrate these jobs.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make a camera	1. Make a pinhole camera.	
2. Develop film	2. Make the necessary solutions and develop a film.	
3. Prove that the real image in a pinhole camera is inverted.	3. Put translucent tissue paper or wax paper over back of pin hole camera to prove inverted image.	Dolan, Edward F., Jr. The Camera Julian Messner, 1 West 39th St. N.Y. NY100 Newhall, Beaumont, and House, George Eastm The Latent Image! The Discovery of Photography Doubleday - Anchor Book Co., 501 Franklin Avenue, Garden City, NY 11531
	4. Discuss role of photographer, developer, and other jobs associated with studio work. Have students list industries and jobs growing out of this beginning, e.g. TV, X-ray Tech, movies, advertising.	Booklet: Katie and Her Camera Hobart $2.63 Simon and Schuster, Inc. 1 West 39 Street New York, NY 10018 Chemistry Job Cluster Chart 143.062 505.884
5. Electroplating	5. Use a solution of silver nitrate to silver plate a clean piece of copper. A storage battery or dry cells will supply the current. Discussion of electroplating industry follows.	
6. Cleaning Silverware.	6. Demonstrate the cleaning of silver by using aluminum and baking soda solution.	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Trapp, Friedl, 1970
Ch. 14 "Precious Metals and Metallic Alloys"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show a relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will describe the role of the chemist in the fuel industry.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

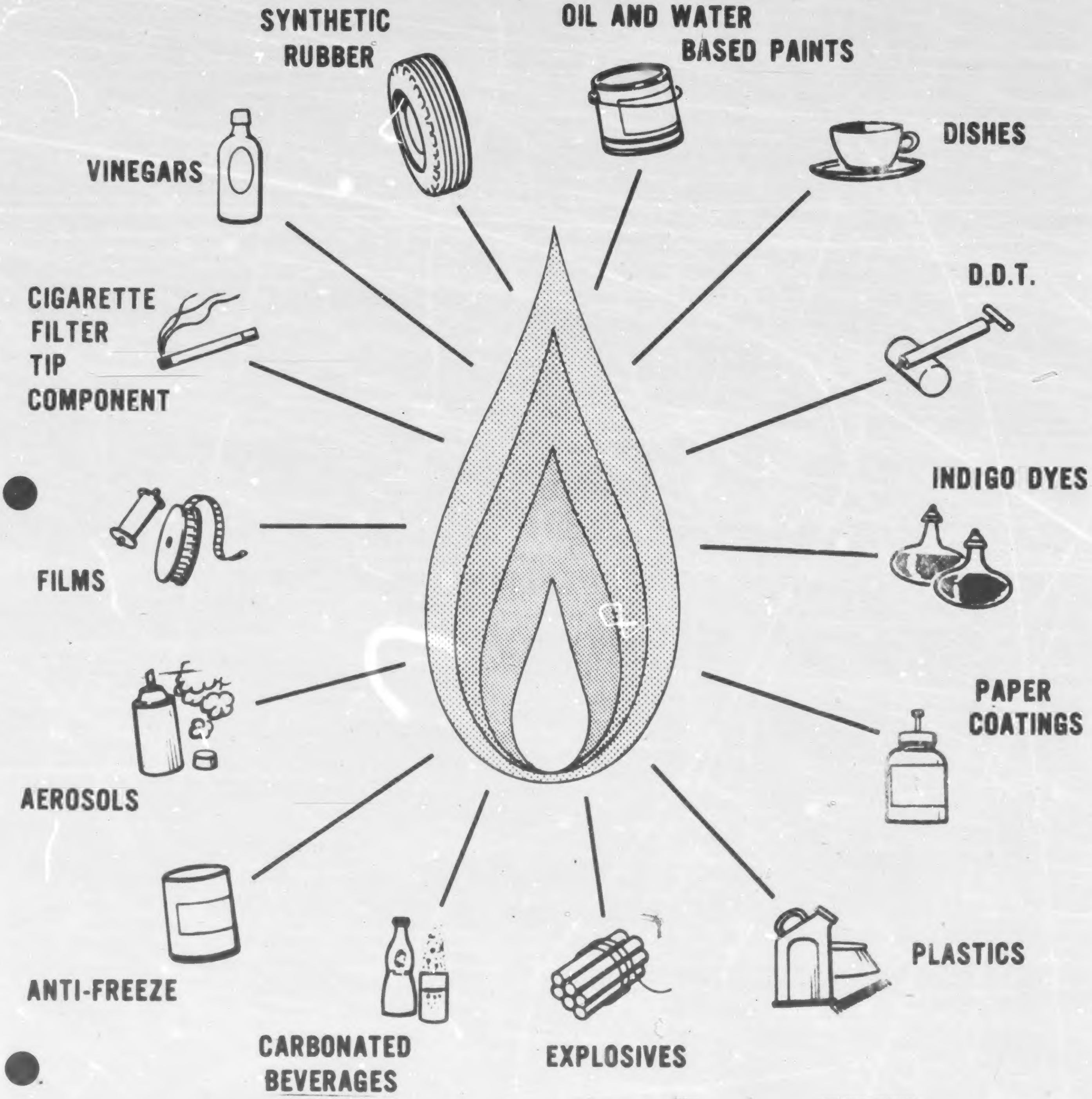
ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Ash determination	1. Determine mass of sample of coal, and after burning, determine mass of ash remaining.	Films (16 mm) Conserving A Heritage color, American Petroleum Institute 1271 Avenue of the Americas, N.Y, NY100
2. Report	2. Report on the production of synthetic industrial diamonds.	The Fuel of the Future (29 min) U. S. Atomic Energy Commission Division of Public Information, Washington, D.C.205
3. Cost of fuels	3. Make a study of the cost of different fuels available in your community on a BTU basis. Then prepare a table computing the BTU per dollar cost in order to determine the most economical fuel.	It might Have Happened (26 min) Color, American Petroleum Institute Story of Gasoline (23 min) U. S. Bureau of Mines, 4800 Forbes Ave. Pittsburgh, PA 15213
4. Origin of methane	4. Hold an inverted bottle filled with water over some decaying leaves or muck at the bottom of a pond. Stir with a stick and catch the bubbles of gas in this bottle as they rise. A mixture of this gas and air will explode when ignited but a full bottle of the gas can safely be ignited.	Filmstrips: "Fossils and Organic Change" (Sound), 47 frames, color "Coal" 49 frames color, Encyclopedia Britannica Films
5. Collection	5. Make a collection of different kinds of solid fuels and show the class your samples.	Chemistry Job Cluster Chart 199.384 Physics " " " 022.281 010.168

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 17, "Fuelds"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
6. Products List	6. Prepare a large chart listing various products made from bituminous coal.	
7. Coke and Charcoal	7. Prepare some coke and charcoal in the laboratory.	
8. Tour	8. Visit a gas plant in your community to learn how it manufactures gas, or obtains and processes natural gas.	
9. Bottle gas	9. Obtain information as to the composition, cost, and heat value of bottled gas sold in your community.	

USES IN INDUSTRY


SYNTHETIC RUBBER
OIL AND WATER BASED PAINTS
DISHES
VINEGARS
D.D.T.
CIGARETTE FILTER TIP COMPONENT
INDIGO DYES
FILMS
PAPER COATINGS
AEROSOLS
ANTI-FREEZE
PLASTICS
CARBONATED BEVERAGES
EXPLOSIVES

A KNOWLEDGE OF THE SCIENCE OF GAS COULD QUALIFY YOU FOR AN INDUSTRIAL OCCUPATION.

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CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose the students to a wide range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, the student will be able to explain in writing how a geologist would locate oil.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make ethyl alcohol.	1. In a large bottle, prepare a water solution of molasses and yeast. Devise a means of passing any gas given off by the mixture into limewater. Allow to stand at room temperature for several days Identify the gas that is given off. Distill a portion of this mixture at about 80° C. Dampen the inside of a beaker with the distille. Does it have an odor? Does it burn? Identify the compound produced. Liquor industry.	Films: (16 mm) Hydrocarbons and Their Structure, (13½ min), color , Coronet Films. Around the Clock (20 min) color, Arabian American Oil Co. 505 Park Avenue, New York, N. 10022 Big Deep, (30 Min) Color, Modern Talkin Picture Company, 1212 Avenue of the Americas, New York, NY 10036 Flowing Solids (15 min), color Modern Talking Picture Company Natural Gas-Energy in the Home (13½ min Color, American Gas AssociationFilm Service 605 Third Avenue, New York, N. Y. 10016
2. Octane rating	2. Find out the octane rating of the different gasolines by asking service station operators or by writing to the oil companies.	
3. Gas from coal.	3. Report to class on how gasoline is made from coal.	
4. Report or talk by geologist.	4. Make a report on how geologists locate potential sources of petroleum.	Physics Job Cluster Chart 024.081
Continued		

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Trapp Friedl, 1970, Ch. 18 "Organic Compounds'

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
5. Report	5. Find out how it is possible to send different petroleum products through the same pipeline in succession without undue mixing of the liquids.	
6. Report.	6. Make a report on oil "hunting" in the oceans and seas of the world.	

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To investigate the various areas of engineering.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will discuss orally the various engineering disciplines needed to construct an arch.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Movie bout engineering followed by discussion of engineering disciplines.	1. During National Engineers Week, invite an engineer to talk to the class about a career in engineering. 2. Engineer can answer students questions and weave the various engineering disciplines into a discussion of the movie, for example structural, civil, electrical, chemical, acoustical lighting, nuclear, mechanical, industrial, aerospace, aeronautical, automotive, refrigeration and air conditioning, petroleum, instrument metallurgical, ceramic, agricultural, mining, safety, sanitary, stationary systems traffic.	Booklet: Your Future in Civil Engineerir Colze, Richard, Rosen Press 29 E. 21st St New York, NY 10010 Film: Gateway to the West Mrs. D. S. Fontana, Pittsburg - Des Moines Steel Company, 1015 Tuttle Street Des Moines, Iowa 50308 Physics Job Cluster Chart 005.081 001.081 726.281 000.782

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedl, 1970, Ch. 19-22

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with how discovery in science affects technology and consequently affects number and types of jobs that will be available.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will write a paragraph explaining how science discovery affects technology and number and types of jobs.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Students will investigate the space industry to discover how advancements in science have created a wide variety of new jobs and how these jobs are flexible and changeable as time and conditions change.	Have students trace the history of the space industry by investigating the following points: a. jobs created - space scientist, space biologist, etc. b. products created for national market - teflon, plastics, etc. c. technological advances made - origin of moon weather satellites, etc. d. economics of space exploration e. industries that have been created due to space discoveries f. present conditions and trends of space work - end of jobs for many people due to phasing out of many facets of the space industry.	NASA Occupational Outlook Handbook Science Careers Kit Careers, Largo, Florida Booklet: "Jobs in Science", Job Family Series #1* Science Research Assoc. Filmstrips/cassettes from Guidance Associates: "Preparing for the Jobs of the 70's"

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Trapp, Friedle, 1970, Ch. 20 "Dynamics of Force and Motion"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To relate occupations to a specific activity in the study of chemistry.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will demonstrate his knowledge of the use of the hydrometer and discuss the occupations related to it.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In studying chemistry and the use of the hydrometer, use a "run down" battery to illustrate how it is used and then relate to student the various occupational fields to which it has application.	1. Secure a "run down" battery.	"Run down" battery
	2. Have students check the dead battery with the hydrometer.	Hydrometer
	3. Recharge the battery and ask students to again use the hydrometer.	Booklet: "Jobs in Science"* #1, Job Family Series, Science Research Assoc.
	4. Relate to students the various uses a chemist has for this instrument.	
	5. Ask each student to list as many uses for the instrument as they can and list an occupation for each use.	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970,
Ch. 21 "Behavior of Matter"
Ch. 32 "Sources of Electricity"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to the work of a hydrological engineer.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity, each student will describe the processes used by the hydrological engineer.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Tour	1. Visit a dam near your home and see how it is constructed. Determine the purpose or purposes of the dam. Learn the acre foot capacity of the dam, why it was constructed of the materials that it is, and what its main purpose is.	Filmstrip Triumph of Mechanics set of 26 single concept film loops (super 8) Ealing Films (16mm) Films Conservation of Energy (27 min) Elastic Collision and Stored Energy (28 Energy and Its Forms (11min) Laws of Conservation and Matter (8 min) Matter and Energy (11 min) Nature and Energy (11 min) Energy and Its Transformation (11 min) EBF Energy and Matter (9 min) Energy and Work 28 min How we get our Power 11 min McGraw Hill Physics Job Cluster Chart 005.081
2. Calculate horsepower	2. Time yourself running up a flight of stairs.	
3. Pamphlets	3. Write to the Superintendent of Documents, Washington D. C. for pamphlets on the following subjects: (a) The Grand Coulee Dam; (b) The Tennessee Valley Authority; (c) The Missouri River Basin Project; (d) The St. Lawrence Seaway	
4. Tour	4. Pile drivers are at work on large construction jobs in cities and well-drillers are busy drilling water wells in the country. Try to find one in operation and observe how it works. Estimate amount of work done by each blow of the falling weight.	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 22, "Work, Power, Energy"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To use a laboratory activity to show how a research physicist would determine a standard.

SPECIFIC BEHAVIORAL OBJECTIVE: To have the students find the relationships between calories and B.T.U.'s through a laboratory activity.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Find relationships between B. T. U's and calories.	1. Record both the farenheit and centigrade temperatures of 1000 ml of tap water. Heat the water and take the final temperature readings. Compare B.T.U.'s to calories and the class average can be calculated to see how accurate they are. The physist would repeat the trials until it was reproducable. For example: 2.2 pounds of water rose from 77°F to 113° F, that is 79.2 B.T.U.'s 1000 grams of water rose from 25°C to 45°C, that is 20,000 calories. They would then get the accepted values of 1 B. T. U=252 calories. Note: Only with distilled water would 1000 ml = 2.2 lbs. Therefore under reasons for not finding the accepted values, this is one of the reasons.	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 23 "Heat Energy"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose the students to the occupation of mechanical engineer.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the students will be able to list four specific duties of a mechanical engineer.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make a large-scale drawing of the gas turbine of a jet plane and explain it to the class. 2. Automobile 3. "Glow plug" 4. Control of the speed of engines 5. Visitation by airline personnel.	1. Refer to Boumphrey Geoffrey Engines and How They Work, Watts, 1960, then discuss the construction and action of three kinds of jet engines. 2. Demonstrate the action of the gasoline engine, using a cut-away model from the school shop, or large labeled diagrams. 3. Demonstrate the roll of clutch and transmission gears in an automobile. 4. Demonstrate the uses of differential gears of an automobile. 5. Report on the uses of overdrive, fluid drive, and automatic transmissions in automobiles. 6. Demonstrate the use of "glow plug" of a model airplane engine. Compare its action with the ignition system of a diesel engine. 7. Make a small centrifugal governor and demonstrate it to the class. 8. Arrange with Northwest Airlines for a pilot and a stewardess to talk to class.	Films from McGraw-Hill: "An Introduction to Jet Engines" 14 min. "Diesel Engine" (Ideal Diesel Cycle) 8 min. "Gasoline Engine" (Otto Cycle) 8 min. "The Steam Engine" (11 min.) Films from Shell Oil Co. (free rental) "The Gas Turbine" (15 min.) "The Diesel Story" (19 min.) Film from Coronet: "Engines and How They Work" (11 min.) Film from Encyclopaedia Britannica: "The Steam Engine: How It Works" (11 min.) Film from Babcock & Wilcox (free rental) "Steam for Power" (41 min.) Transparencies: "Combustion Engines" Minnesota Mining

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedl, 1970, Chapter 24, "Engines"
Physics Job Cluster Chart 196.283, 196.188, 002.081

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: , To show the relationship of school subjects to specific occupations.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will explain in writing the responsibilities of an architect, and acoustical engineer in regard to building design.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Ripple tank	1. Design and build a ripple tank of your own. Use the tank to show the phenomena of reflection and interference of waves. Demonstrate cancellation and discuss "quiet spots" of auditoriums and use role of the acoustical engineer in designing them.	"Magnetic Story" (25 min.) Free rental 3M Co. Bond, B. Burtis, "A Ripple Tank Stroboscop *The Science Teacher*, Volume 30, No. 5 Page 48
2. Voice patterns	2. Use an oscilloscope to demonstrate different wave patterns to the class. Show each student his voice pattern.	Strong, C. L., "The Amateur Scientist: How to Make a Ripple Tank to Examine Wave Phenomena," *Scientific American*, October 1962, Page 171
3. Wave patterns in springs	3. Obtain two coiled springs, one of which is made of a denser material than the other. Fasten them securely end-to-end, and investigate the wave formations produced by this combination. Record your results, using diagrams, and explain your results.	Films: (16 mm) *Approaching the Speed of Sound* (27 min) Free rental Shell Oil Co. *Fundamentals of Acoustics* (11 min) EBF
4. Speed of sound	4. Look up Kundt's experiment for measuring the speed of sound in a metal. Try to extend the experiment	*Looking at Sounds* (10 min) McGraw Hill

SUGGESTED CORRELATION FOR THIS ACTIVITY: *Modern Physical Science*, Tracy, Tropp, Friedl, 1970, Ch. 25 "Wave, Motion and Sound"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	to find the speed of sound in carbon dioxide by filling the tube with this gas.	The Nature of Sound (11 min) Coronet Progressive Waves: Transverse and Longitudinal (9 min) McGraw Hill Sound Recording and Reproduction (11 min EBF Sound Waves and Stars: The Doppler Effe (12 min) Film Assoc. Sound Waves and Their Sources (12 min) EBF Sound Waves in Air (36 min) MLA Transparencies: Physics - Waves, 20 overheads 3M Co. Physics Job Cluster Chart 726.281 and 001.081
5. Report	5. Prepare a report on how bats use sound waves to guide them in flight. Use of sonar and radar in navigation can be stressed.	
6. Auto horn	6. Take apart an old automobile horn, and explain how it produces sound.	
7. Work of geologist	7. With the help of charts, explain how the seismograph makes use of sound waves to locate earthquakes.	
8. Reinforcement of sounds	8. Place two large parabolic reflectors across the room from each other, and aim them at each other. Put a ticking watch at the focus of one of them. With your ear at the focus of the other, try to hear the watch. Explain.	

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To investigate the optical industry.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will explain in writing the procedures of an optical mechanic.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Grind and polish a glass mirror and build your own telescope.	Directions supplied by: 1. Scientific American 2 West 45th Street New York 36, NY 2. Brown, Sam Homebuilt Telescopes Edmund Scientific 3. Brown, Sam, Mounting Your Telescope Edmund Scientific 1967 Edmund Scientific Company 400 Edscorp Building Barrington, NJ 08007 From the knowledge gained discuss lenses for eye glasses and microscopes.	Kit of 40 booklets with teachers edition entitled Living With Light, free (paid for by local utility) available from The Cooperative Teaching Aid Plan, Better Lights Better Sights Bureau 90 Park Avenue New York, NY 10016 Physics Job Chart 079.108 070.108

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedle, 1970
Ch. 27, "The Nature of Light"
Ch. 28, "The Refraction of Light"

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To become aware of the role played by fluorescent lights in selling merchandise.

SPECIFIC BEHAVIORAL OBJECTIVE: By using a color camparator box the student will determine some of the factors that a lighting engineer must consider when designing a lighting system.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Have students make a color comparator box.	1. Using the available plan construct the box and demonstrate.	Plans available from: Marvin R. Hooge Lighting Director M. D. U. 400 N. 4th Bismarck, ND 58501
	2. Discuss how an interior decorator, clothing designer, advertizer, store merchandiser, architect, engineer, office manager, housewife, etc. use color to sell merchandise and provide a healthy environment.	Books: Freeman, Ira. M. Science of Light and Radiation, 1968 Random House In 201 East 50th Street, New York, N.Y. 1002 Gill, Bob, What Color is Your World 1963 Grosset and Dunlap, Inc. 51 Madison Avenue New York, N. Y. 100 Hellman, Harold, Art and the Science of Color 1967, McGraw-Hill Book co. I 330 West 42nd Street New York, N.Y 10 Radlauer, Ruth and Ed. Colors 1968 Bowman Pub. Corp. 622 Radier Dr. Glendale California 91201 (Continued)

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970
Ch. 29, "Color"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
		Films: (16 mm) Color and Light: An Introduction 11 min Coronet The Nature of Color (11 min) Coronet Instructional Films 65 East South Water St., Chicago, Ill 60601 Discovering color, (15 min) Film Associat of California, 11014 Santa Monica Blvd. Los Angeles, California 90025 Filmstrip: Light and Color Series of four single - concept film loop (8 mm) International Communication Films, Division of Doubleday, 870 Monterey Park California 91754 Number 47752, Dr. Heidegger's Experiment, A Discussion of Color $135.00 Encyclopaedia Britannica Educational Corp. 425 N. Michigan Ave. Chicago, Ill 60611 Physics Job Cluster Chart 079.108 070.108

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with how BTU's are instrumental in the air conditioning industry.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will calculate the BTU rating for their home air conditioning or heating unit and list five occupations related to the heating and refrigeration areas.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
When dealing with heat and fuels, have students calculate the BTU rating needed to air condition or heat their own home and relate a number of occupations in the heating and refrigeration areas.	1. Obtain the formula used to calculate BTU rating. 2. Have students figure the areas of their own homes and then have them calculate the size of central air conditioner or heating unit they would need. 3. Ask students to list a number of occupations that this knowledge would be needed for. 4. Have any interested student investigate a common occupational choice and report to the class on some details of that occupation.	Films: Principles of Refrigeration - 20 min. U. S. Office of Education Washington, D. C. Gas for Home and Industry - 14 min. American Gas Association 420 Lexington Avenue New York 16, New York FREE

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To investigate the occupations in the field of electricity.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will briefly explain in writing the relationship between boiler, turbine, auxillary equipment, and switchboard operators.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Concentration of electrolyte	1. Set up a bell jar with two cooper plates, a dry cell, and an ammeter in the circuit. Pour 250 cc of distilled water into the jar. Then dissolve ½ gram of salt (NaCl) in the water and read the ammeter. Continue to add salt in ½ gram portions and record the ammeter reading each time. Plot the current versus the salt concentration or a graph to determine the relationship between these two quantities.	Modern Physical Science, Tracy Tropp Frie Copyright 1970, Ch. 32 Sources of Electr city. Filmstrips: (35 mm) "Producing Small Amounts of Electricity" Jam Handy Films: (16 mm) Battery Electricity (13 min) The Electromotive Force Series (12 min) McGraw Hill Electrochemical cells (22 min) MLA Photoelectric Effect (28 min) MLA Electrochemical Reactions (14 min) Electrochemistry (11 min) Coronet Making Electricity (10 Min) Primary Cell (11 min) Encyclopaedia Britannica Films
2. Make a simple cell.	2. Make a simple cell by inserting two different metals; such as copper and zinc, into a lemon. (The lemon juice serves as an electrolyte) The tiny current which results can be detected by connecting wires to a galvanometer. Use a variety of metals and compare the galvanometer readings produced by each different pair of electrodes. Relate to coating industry the role of zinc in protecting underground steel structures (continued)	

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Trapp, Friedl, 1970
Ch. 32 "Sources of Electricity"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	(Zinc is more active than steel so it is slowly disintegrated in an electrochemical action while steel in preserved.)	
3. Produce electricity by hand crank generator.	3. Crank a hand generator sufficient to light a small flash light bulb. Show that there must be some type of energy conversion in the generation of electricity. Discuss the roles of operators (a) boiler, (b) turbine (c) auxiliary equipment, (d) switchboard generation and finally watch engineers in the generation of electricity.	

CAREER DEVELO T ACTIVITIES

BROAD OBJECTIVE: To acquaint students with the wide variety of jobs available in a utilities company.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will identify six job occupations that exist at a utilities company.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Have students calculate the electric bill at their own homes and acquaint them with the many occupations available to them in a utilities company.	1. Take a field trip to a utilities company and have students view the various types of work there. 2. Obtain the local power company rates. 3. In terms of the electrical items in their home, have students calculate the watt-hours of each item and then calculate the electric bill.	Your Future in Electronics - 24 min. RCA Institute Inc. 350 W. Fourth Street New York, New York FREE
Field Trip	4. List six occupations that are involved in calculating a person's electric bill. 5. Have students write a brief summary of what each of these people do.	

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To expose students to a wide range of occupational opportunities.

SPECIFIC BEHAVIORAL OBJECTIVE: The students will orally discuss the jobs of load dispatcher, sub-station operator, lineman, troubleman, groundman, and cable splicers while building a transformer.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Make an electromagnet	1. Set up three simple electromagnets. The first A, should have 15 turns of wire and one battery; B, 30 turns of wire and one battery; C, 15 turns of wire and two similar batteries connected in series. Determine the relative strength of each electromagnet by picking up pins or paper clips.	Films: (16 mm) Electricity: How It Is Generated (13 min Electromagnetic Induction (14 min) Coron Electrodynamics (11 min) Magnetism (16 m Encyclopaedia Britannica Films Electromagnets (11 min) Magnetism and Electricity (17 min) Principles of the Generator (10 min) McGraw Hill Films Exploring Electromagnetic Energy (9 min) Film Associates. A Magnet Laboratory (21 min) M. L. A. Principles of Magnetism (8 min) De Vry
2. Make a simple motor.	2. Refer to Boy Scout Handbook.	
3. Set up a telegraph relay.	3. After sending a message discuss how communications developed from this simple beginning.	
4. Build a 10X transformer.	4. Wrap 10 coils of wire around one side of an iron core and 100 coils around the other side. Using your lab transformer step down the voltage put into the student transformer to safe levels. Discuss electrical transmission lines that operate at 300,000 to 400,000 volts and the roles of load dispatcher, substation operators, lineman, troubleman,	Filmstrips: (35 mm) "AC and DC Generators" Long Filmslide Svc "Alternating Current Circiuts"McGraw Hil "Electromagnets and How They Work" Jam Han "How Electricity is Used in the Home" Jam Handy "Transformers" Long Film Slide Svc.
5. Boil water with electricity.		

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Trapp, Friedl, 1970, Ch. 33, "Electromagnetism"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
	4. (continued) groundmen, and cable splicers. 5. Using a heater boil a quart of water and calculate the cost needed to boil the water. If you time it you can determine the factor in the formula. Calories= 0.24 x amps^2 x ohms x seconds	Filmstrips: 8 mm "Magnets" International Communications Super 8 -"Electromagnetism"Ealing Transparencies "Magnetism and Electromagnatism" set of 20 overheads 3M Co. Physics Job Cluster Chart 003.087 Resource person: Utility Company

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To develop understanding of the tools used by a scientist.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity the student will be able to demonstrate his knowledge of the tools of a scientist by listing five scientific tools.

SUGGESTED SUBJECT AREA Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
Identify several specimens from each of the three kingdoms. How does this activity relate to the many fields of life science.	Provide specimens, eg. fossil plants and animals, local pond water local plants local insects By use of microscopes, identification guides, textbooks and other identification aids have students identify the specifmens and report the procedures used. Discuss the various occupations related to the activity eg. taxonomist paleantologist, farmer, horticulture marine biology.	Local environment - pond water fossils plant life microscope Identification guide eg. Trees of North Dakota - Insects of North Dakota Local Resource people Paleantologist Geologist Horticulturist Entomologist Bacteriologist County Agent Filmstrips SRA Career Information Kit

SUGGESTED CORRELATION FOR THIS ACTIVITY:

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquaint students with how important measurement is in the autc mechanics industry.

SPECIFIC BEHAVIORAL OBJECTIVE: Each student will demonstrate a knowledge of how to use the vernier caliper and the micrometer by measuring a defective engine part.

SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
In teaching the use of the vernier caliper and the micrometer, illustrate by having students measure camshaft and crankshaft and relate the importance of knowing how to use these instruments in the auto mechanics area.	1. Secure a section of a defective camshaft or crankshaft. Be sure to get a table showing the tolerance. 2. Mark specific areas on the camshaft and crankshaft for students to measure. 3. Relate to students that measurement with a vernier caliper can show flat areas and the micrometer can show that the shaft does not lie within "tolerances" and must be replaced. 4. Ask students to list other occupations in which these instruments might be used. Note: Snowmobile pars are usually less than 1" in diameter and most lab micrometers are too small to measure automobile engine parts.	A Power Primer, General Motors Corp. Educational Relations Section P. O. Box 177, North End Station Detroit 2, Mich. 101 pages FREE Booklet: A Job with a Future in Auto Mechanics Biegeleisen $3.59 E. M. Hale and Co. Box B-1473 Minneapolis, MN 55480 Films: ABC of Internal Combustion, 13 min. ABC of Automobile Engines, 21 min. General Motors Corp. FREE The Gas Turbine Shell Oil Company 624 South Michigan Avenue (Continued)

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy Tropp Friedl, 1970, Ch. 1 "Measurement of Matter"

CONTINUATION ACTIVITY SHEET

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
		Chicago 5, Ill. FREE Poster: History of Measurement - Ford Motor Co. Information Services Dearborn, Michigan FREE Physics Job Cluster Chart 023.081

CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To show a relationship between school subjects and opportunities that exist throughout life.

SPECIFIC BEHAVIORAL OBJECTIVE: After completion of this activity each student will list at least three jobs where precise measurement is important and how it is important.

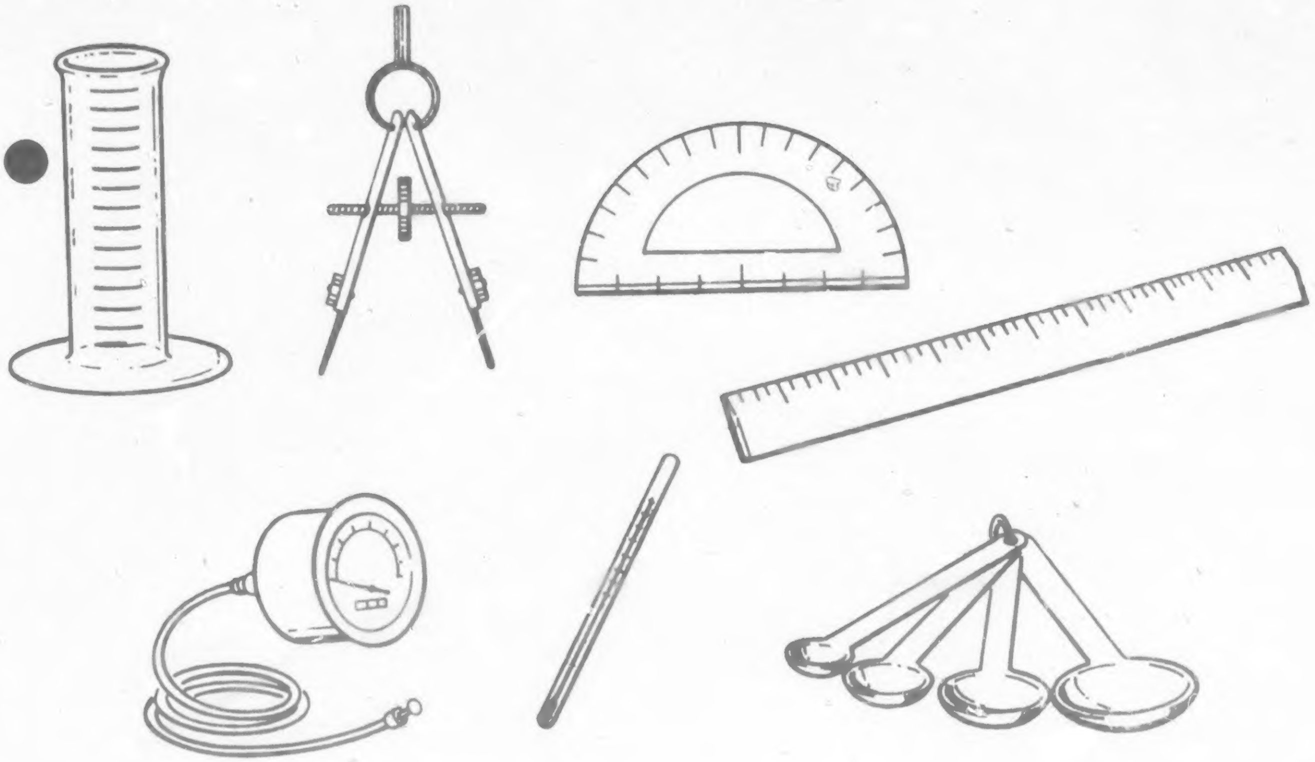
SUGGESTED SUBJECT AREA Physical Science

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. For students interested in careers in medicine and or biological sciences	1. Obtain the necessary chemicals and equipment so that the students can cound their own red blood cells. 2. Discuss measurement in our world and the jobs and professions that need precise measurements. 3. Discuss a variety of instruments that are used for precise measurement such as a micrometer, caliper, or other scientific tool.	Poster - History of Measurement Ford Motor Company, Information Services Dearborn, Michigan FREE Film (16 mm) Classifying Matter - The Need (35 min), b/w or color, Encyclopedia Britannica Education Corporation, 425 Nort Michigan Avenue, Chicago, Illinois Also available from EBEC: Film loops, 8 m color, 3 min. Weighing Procedure Using a Balance Scale Booklets: The Story of Figures Burroughs Corporatio The Amazing Story of Measurement The Lufkin Rule Co. FREE Precision - A Measure of Progress General Motor FREE (continued)

SUGGESTED CORRELATION FOR THIS ACTIVITY: Modern Physical Science, Tracy, Tropp, Friedl, 1970, Ch. 1 & 2, "Measurement of Matter" and "Matter - Its Properties and Changes"

TO THE NURSE, HOMEMAKER, CHEMIST, DRAFTSMAN, CARPENTER, AND MECHANIC, ACCURATE MATHEMATICAL MEASUREMENT IS VITAL.



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CAREER DEVELOPMENT ACTIVITIES

BROAD OBJECTIVE: To acquain- students withhow the BTU rating of their air conditioner is calculated.

SPECIFIC BEHAVIORAL OBJECTIVE: Have interested students calculate the BTU rating of their home for an air conditioning system.

SUGGESTED SUBJECT AREA Physics

SUGGESTED GRADE LEVEL Jr. - Sr. High

ACTIVITY	SUGGESTED TECHNIQUE	RESOURCE MATERIALS
1. Obtain your house plan or measure your home and make your own plan. Calculate BTU rating of an air conditioner for the home.	1. Using a house plan and the example provided, have the students calculate the BTU rating of a central air conditioner.	Your local air conditioner dealer These materials courtesy of Montana Dakota Utilities, 400 N. 4th St., Bismarck, ND 58501
2. Have students calculate BTU rating of an air conditioner for their room.	2. Have the students try to obtain the factors used in these calculations.	Modern Physical Science, Tracy Tropp Friedl, 1970, Chapter 23, "Heat Energy"
3. Teachers example could be of the classroom or the example that is included.	3. During the example that is given by the teacher discuss: A. Drafting of the blueprint. B. Research physist determining the factors for 1) the NE and NW wall (they are small) 2) the SW wall 3) the SE wall (it's the largest) C. An air conditioning engineer D. The air conditioner designer E. The installation men F. The sheet metal workers G. The air conditioner servicemen	"How We Measure Heat", McGraw-Hill (filmstrip) "Heat and It's Control", (film) Bureau of Mines, 4800 Farbes, Ave., Pittsburg, Pa. Physic job cluster chart 017.281

SUGGESTED CORRELATION FOR THIS ACTIVITY:

MONTANA-DAKOTA UTILITIES CO.

Cooling Load Estimate

Design Temperatures	SUMMER		WINTER
	Dry Bulb	Wet Bulb	Dry Bulb
Outside	°F	°F	°F
Inside	°F	°F	°F
Temp. Difference	Cooler °F	▨	Warmer °F

NAME:

LOCATION:

FIGURED BY:

DATE:

EXTERNAL LOADS									SUMMARY	
Item No.	SURFACE	AREA	Hourly Summer Load Analysis Sun Heat Combined With N.T. Load at 15°T.						SENSIBLE	
			AM PM		AM PM		AM PM			
			Factor	B.X.C B.T.U.	Factor	B.X.E. B.T.U.	Factor	B.X.G. B.T.U.	Factor	B.T.U.
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
1.	N Glass NE								▨	▨
2.	E Glass SE								▨	▨
3.	S Glass SW								▨	▨
4.	W Glass NW								▨	▨
5.									▨	▨
6.									▨	▨
7.									▨	▨
8.									▨	▨
9.									▨	▨
10	N Wall NE								▨	▨
11	E Wall SE								▨	▨
12	S Wall SW								▨	▨
13	W Wall NW								▨	▨
14									▨	▨
15									▨	▨
16									▨	▨
17									▨	▨
18									▨	▨
19	Roof								▨	
20	Insert Max. Load in Col. J.		▨		▨		▨			
21	Ceiling		▨	▨	▨	▨	▨	▨		
22	Floor		▨	▨	▨	▨	▨	▨		
23	Partition		▨	▨	▨	▨	▨	▨		
24			▨	▨	▨	▨	▨	▨	▨	
25	Total External Load		▨	▨	▨	▨	▨	▨		

FORM 597

Item No.		LOAD SUMMARY			
		SENSIBLE		LATENT	
		Factor	B.T.U.	Factor	B.T.U.
		I.	J.	K.	L.
25	Total External Load	▨		▨	▨
	INTERNAL LOADS	▨	▨	▨	▨
26	People No. of People X Col. I & Col. K.				
27	Lights Watts X Col. I	3.4		▨	▨
28	Appliances				
29	Motors H.P. X Col. I			▨	▨
	OUTSIDE AIR LOAD	▨	▨	▨	▨
30	Ventilation Requirements cfm	▨	▨	▨	▨
31	Infiltration cfm cfh				
32	Exhaust Fan Capacity cfh Use Largest Amount	▨	▨	▨	▨
	ADDITIONAL LOADS (When Design T_d is Greater than 15°)	▨	▨	▨	▨
33	Total Glas Area Sq. ft. x Col. I.			▨	▨
34	Total Wall Area Sq. ft. x Col. I.			▨	▨
35	Total Roof Area Sq. ft. x Col. I.			▨	▨
36				▨	▨
	SUMMARY OF COOLING LOADS	▨	▨	▨	▨
37	Grand Totals	▨		▨	
38	Total Cooling Load (Item 37 Col. J + Col. L.)			B.T.U. 1 hr.	
39	Total Tons Refrigeration Load (Item 38 ÷ 12000)			Tons	
40	Ratio of Latent Heat to Total Heat			o/o L.H./T.H.	

EQUIPMENT	COST INSTALLED

Back of Form 597

MONTANA-DAKOTA UTILITIES CO.

Cooling Load Estimate

Design Temperatures	SUMMER		WINTER
	Dry Bulb	Wet Bulb	Dry Bulb
Outside	°F	°F	°F
Inside	°F	°F	°F
Temp. Difference	°F Cooler		°F Warmer

NAME:

LOCATION:

FIGURED BY:

DATE:

EXTERNAL LOADS									SUMMARY	
Item No.	SURFACE	AREA	Hourly Summer Load Analysis Sun Heat Combined With N.T. Load at 15°T.						SENSIBLE	
			AM PM		AM PM		AM PM			
			Factor	B.X.C. B.T.U.	Factor	B.X.E. B.T.U.	Factor	B.X.G. B.T.U.	Factor	B.T.U.
	A.	B.	C.	D.	E.	F.	G.	H.	I.	J.
1.	N Glass NE	36.0	12	432.0	18	648.0	16	576.0		
2.	E Glass SE	54.0	83	4482.0	18	972.0	16	864.0		
3.	S Glass SW	56.0	59	3304.0	65	3640.0	23	1288.0		
4.	W Glass NW	45.0	12	540.0	89	4005.0	135	6075.0		
5.										
6.										
7.										
8.										
9.										
10	N Wall NE	304.0	-		1	403.0	1	304.0		
11	E Wall SE	364.0	3	1092.0	1	364.0	1	364.0		
12	S Wall SW	304.0	-		3	912.0	2	608.0		
13	W Wall NW	368.0	-		2	736.0	4	1472.0		
14										
15										
16										
17										
18										
19	Roof	1428.0	4	5,712.0	6	8568.0	5	7140.0		
20	Insert Max. Load in Col. J.			15,562.0		20,149.0		18,691.0		20,149.0
21	Ceiling									
22	Floor	1428.0							3	4284.0
23	Partition									
24										
25	Total External Load									24,433.0

FORM 597

Item No.			LOAD SUMMARY			
			SENSIBLE		LATENT	
			Factor	B.T.U.	Factor	B.T.U.
			I.	J.	K.	L.
2[illegible]	Total External Load		▨	24433.0	▨	▨
	INTERNAL LOADS		▨	▨	▨	▨
26	People	No. of People 10 X Col. I & Col. K.	195	1950.0	205	2050.0
27	Lights	Watts X Col. I	3.4		▨	▨
28	Appliances					1200.0
29	Motors	H.P. X Col. I			▨	▨
	OUTSIDE AIR LOAD		▨	▨	▨	▨
30	Ventilation Requirements cfm	Use Largest Amount	▨	▨	▨	▨
31	Infiltration 11,424.0 cfm	cfm	.35	3998.0	.26	2970.0
32	Exhaust Fan Capacity cfm		▨	▨	▨	▨
	ADDITIONAL LOADS (When Design T_d is Greater than 15°)		▨	▨	▨	▨
33	Total Glas Area	Sg. ft. x Col. I.		36601.0	▨	▨
34	Total Wall Area	Sg. ft. x Col. I.			▨	▨
35	Total Roof Area	Sg. ft. x Col. I.			▨	▨
36					▨	▨
	SUMMARY OF COOLING LOADS		▨	▨	▨	▨
37	Grand Totals		▨		▨	6,220.0
38	Total Cooling Load (Item 37 Col. J + Col. L.)			3 Ton	B.T.U. 1 hr.	
39	Total Tons Refrigeration Load (Item 38 ÷ 12000)				Tons	
40	Ratio of Latent Heat to Total Heat				% L.H./T.H.	

EQUIPMENT	COST INSTALLED

Back of Form 597

APPENDIX A

Guideline for an Individual Research Study of an Occupation

STUDY OF A CAREER

Research and Planning Outline Form

I. NAME OF THE CAREER OR CAREER FIELD ______________________

A. Is there a DOT number for this career? ______________________

B. Other names often used for this career? ______________________

____

C. Reasons for selecting this particular career to study. __________

____

II. HISTORY OF THE CAREER ______________________

____

____

III. PEOPLE IN THIS CAREER

A. Approximately how many people are now employed in this career field? ______________________

B. Briefly discuss current employment trends relating to this career.

____

____

C. Where are jobs related to this career most often found? Why?

____

____

IV. DUTIES OF THIS CAREER

A. General duties ______________________

____

____

B. Specific duties ______________________

____

C. Hours of work ordinarily required ______________________

D. Is there anything unusual about the number of hours or nature of the work schedule which might relate to this job field? (Seasonal fluctuations, days, nights, split shifts, etc.)

____

____

V. QUALIFICATIONS OF WORKERS IN THIS FIELD:

A. Sex ____________________________________

B. Age ____________________________________

C. Health and physical __________________________

____

D. Personality ________________________________

E. Experience ________________________________

____

F. Aptitudes _________________________________

____

G. Education (general level and type required) ____________

____

____

H. Other ___________________________________

____

I. What are the most common methods of entry into this career? ____

____

Which one would you choose? ______________________

Why? ____________________________________

____

VI. EDUCATIONAL PLANNING

A. Develop a complete high school program that would be the best preparation for this career, for entry into a post-secondary school if one is necessary for this career.

B. Are post-secondary vocational-technical schools involved in the preparation for this career. Give specific examples

C. If you decide to attend a post-secondary school, what entrance requirements might you expect? What courses would you expect to take? What is the length of training? Cost of training?

D. Briefly describe any armed forces training opportunities that may relate to this career.

E. Is a college or university education required? If it is, consider the following important factors:

1. Length of college course
2. Specialized courses required for graduation or certification.
3. Approximate cost per year (on-campus or off-campus)
4. What are the scholarships, loans or grants that you could apply for to help with the cost of this training?

F. Other Training (Discuss)

1. Is this an apprenticeable program? ____________________

2. Company training program ____________________

3. On-the-job training ____________________

VII. RELATED FIELDS

A. List and briefly describe several career fields related to the one you have chosen to explore. (Refer to occupational cluster posters.)

B. List other careers that could effectively utilize the training and experience. ____________________

VIII. FINDING A JOB IN THIS CAREER FIELD

A. Legal requirements for entry into this field ____________________

B. Public and/or private employment agencies that might be helpful in securing a job in this field ____________________

C. Newspaper ads (attach to separate sheet several ads pertaining to this career)

D. Briefly describe the manner in which you would go about making a direct application for a first job in this field ____________

____

____

E. List four local firms where employment in this career field could be found ________________________

____

____

F. If you were to make application for this job, whom would you use for recommendations? List three persons. (refer to appendix A; Letter of application)

____

____

____

G. Write a sample letter of application for this type of position on a separate sheet of paper and attach.

IX. EARNINGS

A. How much can you expect to make from this career?

1. Beginning salary? ____________________
2. Average salary? ____________________
3. Exceptional salary? ____________________

B. What expenses might you have to meet in following this career?

____

____

X. THE NATURE OF THE JOB

A. List some benefits other than salary that you would expect to gain from this career ____________________

____

B. What hazards can you anticipate in this job field?

C. What organizations can you be expected to join?

D. What demands would this career place on a family?

XI. CAREER ADVANCEMENT

A. What are the chances for advancement in this field?

B. Would advancement require additional training? Explain

C. Would advancement require additional duties? Explain

D. Could advancement require moving to another location? Explain

E. Is there a need for continuing education to hold this position?

Explain

XII. ARRANGE AN INTERVIEW with someone employed in this career field. Ask this resource person the same questions you have been exploring in this project and any additional questions you may have. Write a summary of this interview.

XIII. AFTER STUDYING THIS CAREER in depth, state why you would or would not be interested in making this your own career objective.

APPENDIX B

Personal Data Sheet

PERSONAL DATA SHEET

NAME: John Baker
ADDRESS: 319 Oak St., Bismarck, ND 58640
TELEPHONE: 255-3240
MARITAL STATUS: Single

AGE: 19
HEIGHT: 5'11"
WEIGHT: 160

EDUCATION: Elementary School: Cunningham School; graduated 1965
High School: Roosevelt High School; graduated 1969
Commercial course with general business major
Electives included business procedures and bookkeeping

PREVIOUS EMPLOYMENT: Clerk, National Insurance Co., 145 N. LaSalle St.,
Centerville,
June 1969 to present
Clerk, Check-Clearing Dept., State Bank,
917 Dearborn St., Centerville,
June - September 1968
Supervisor: Mr. H. C. Smith

SCHOOL ACTIVITIES: Business Club, football team, Student Council

PRESENT INTERESTS: Photography, camping, record collecting

REFERENCES: Mr. T. R. Preston
Section Manager
National Insurance Co.
145 N. LaSalle St.
Centerville, Ill. 62201
DEarborn 2-9820

Mr. L. E. Fisher
Accounting Instructor, Roosevelt High School
2034 E. Main St.
Centerville, Ill. 62201
NAtional 8-6880

Mr. P. A. Johnson
4839 South Boulevard
Centerville, Ill. 62201
ALpine 1-4906

APPENDIX C

Occupational Clusters for Science

DIAGRAMS FOR EXPLORING OCCUPATIONS RELATED TO SCHOOL SUBJECTS

The diagrams on the following pages are designed to assist students who are undecided about a specific occupation, but have interest in one of the major subject areas. Each occupation has been coded according to the Dictionary of Occupational Titles for easy reference. Students who desire to obtain additional information about a certain occupation can refer to the professional file by the Dictionary of Occupational Titles code number.

The Dictionary of Occupational Titles is a United States Department of Labor publication, and consists of five points:

(1) The occupational title,

(2) the industry designation or work activity with which the occupation is identified,

(3) classification by code number,

(4) alternate titles, and

(5) a brief description of the duties of the occupation.

The D. O. T. is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D, C, 20402.

The above refers to eh D.O.T. (Dictionary of Occupational Titles) 1965 Third Edition, Volumns I & II.

Suggestion: The diagrams can be used on bulletin boards or for class discussions. (We would be interested to know how your school uses this information, particularly if the methods are different from those listed above.)

Mail Order Form to: D.O.T. ORDER FORM (All orders are prepaid)
Superintendent of Documents, Government Printing Office, Washington D. C. 20402

Enclosed find $_______ (check or money order)

Please send me ______ Volume I - Definitions of Titles - at $5.00 each

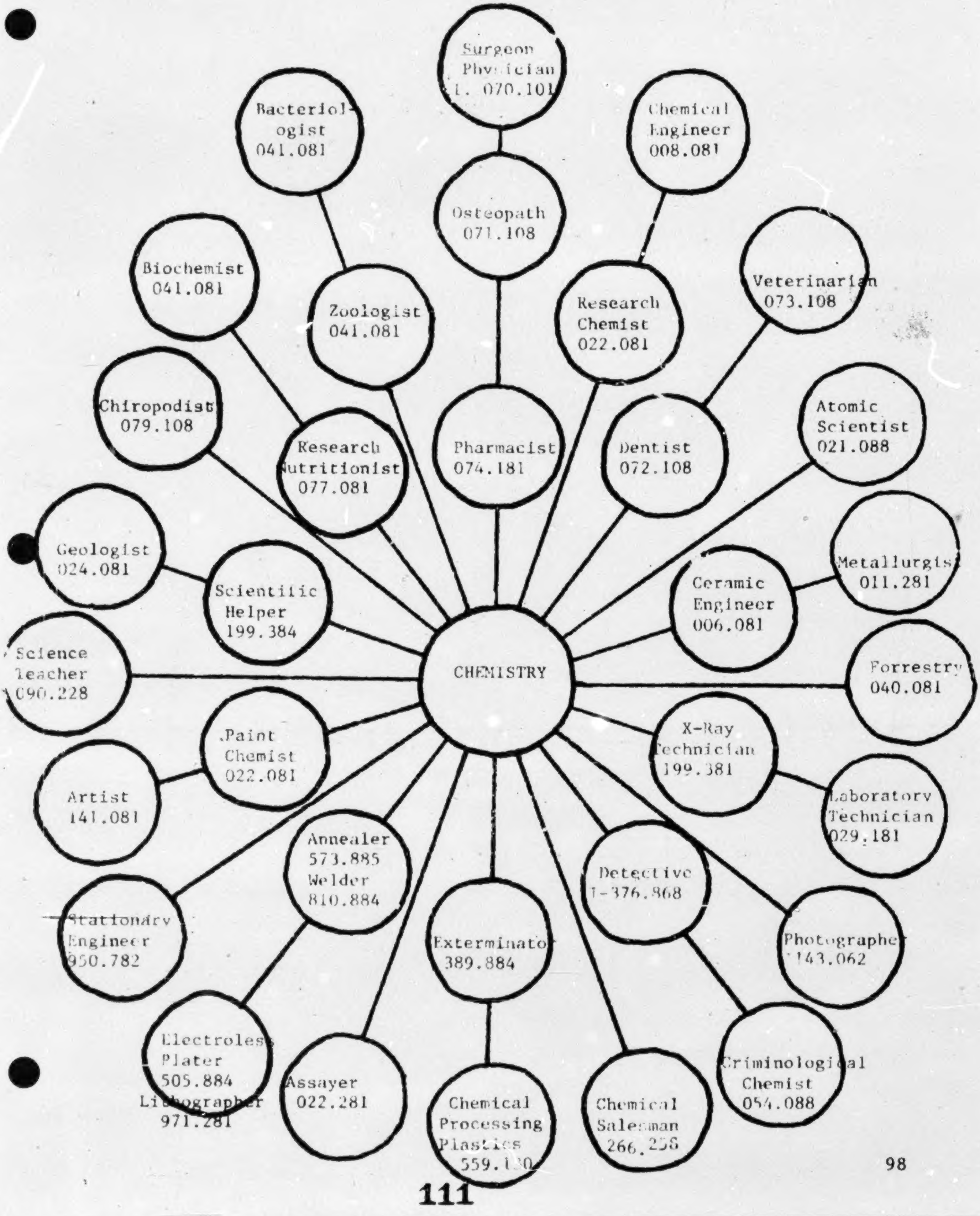
Please send me ______ Volume II - Occupational Classification - at $4.25 each

Name_________________________________ School_____________________________

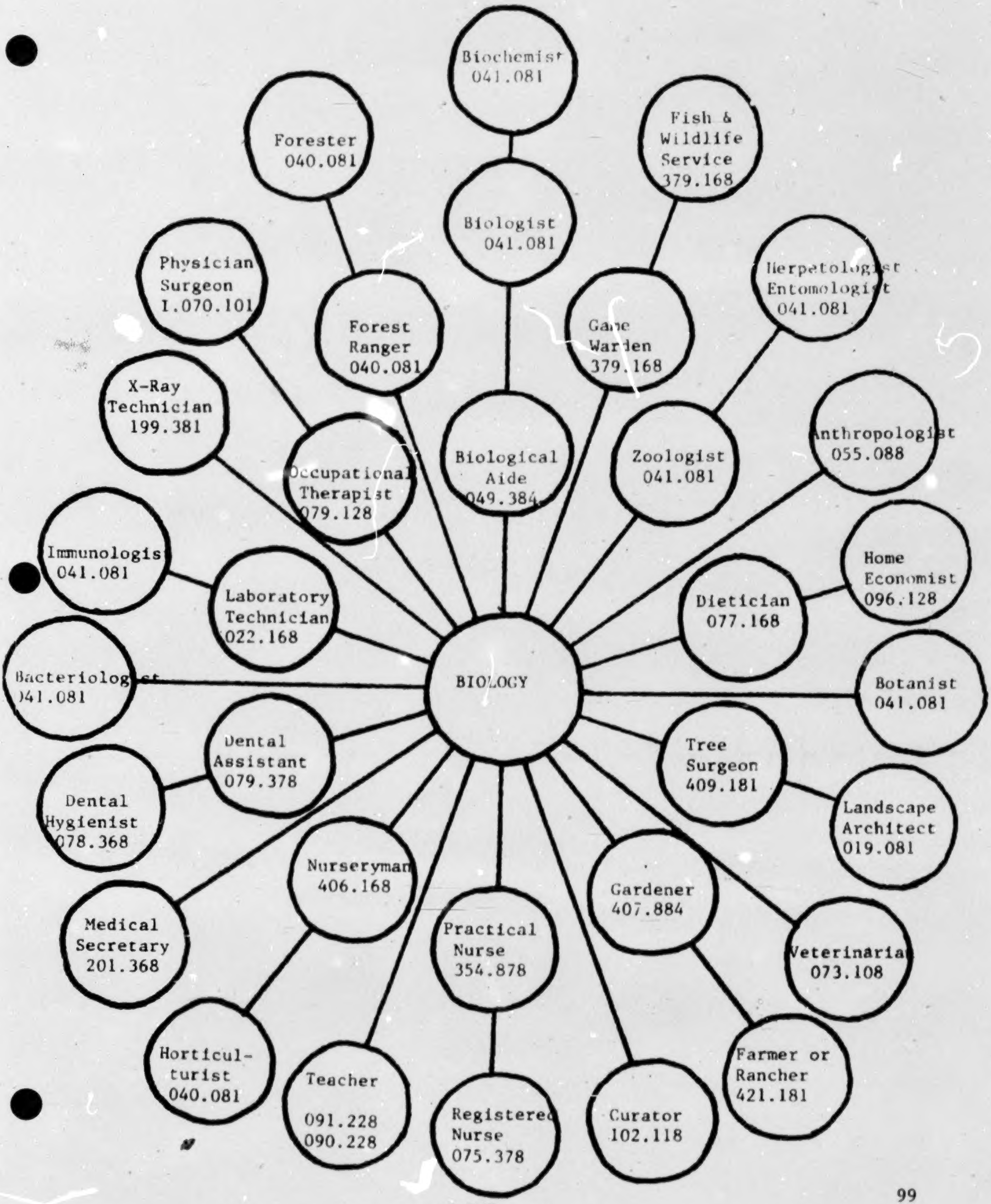
Street Address____

City, State and ZIP Code____

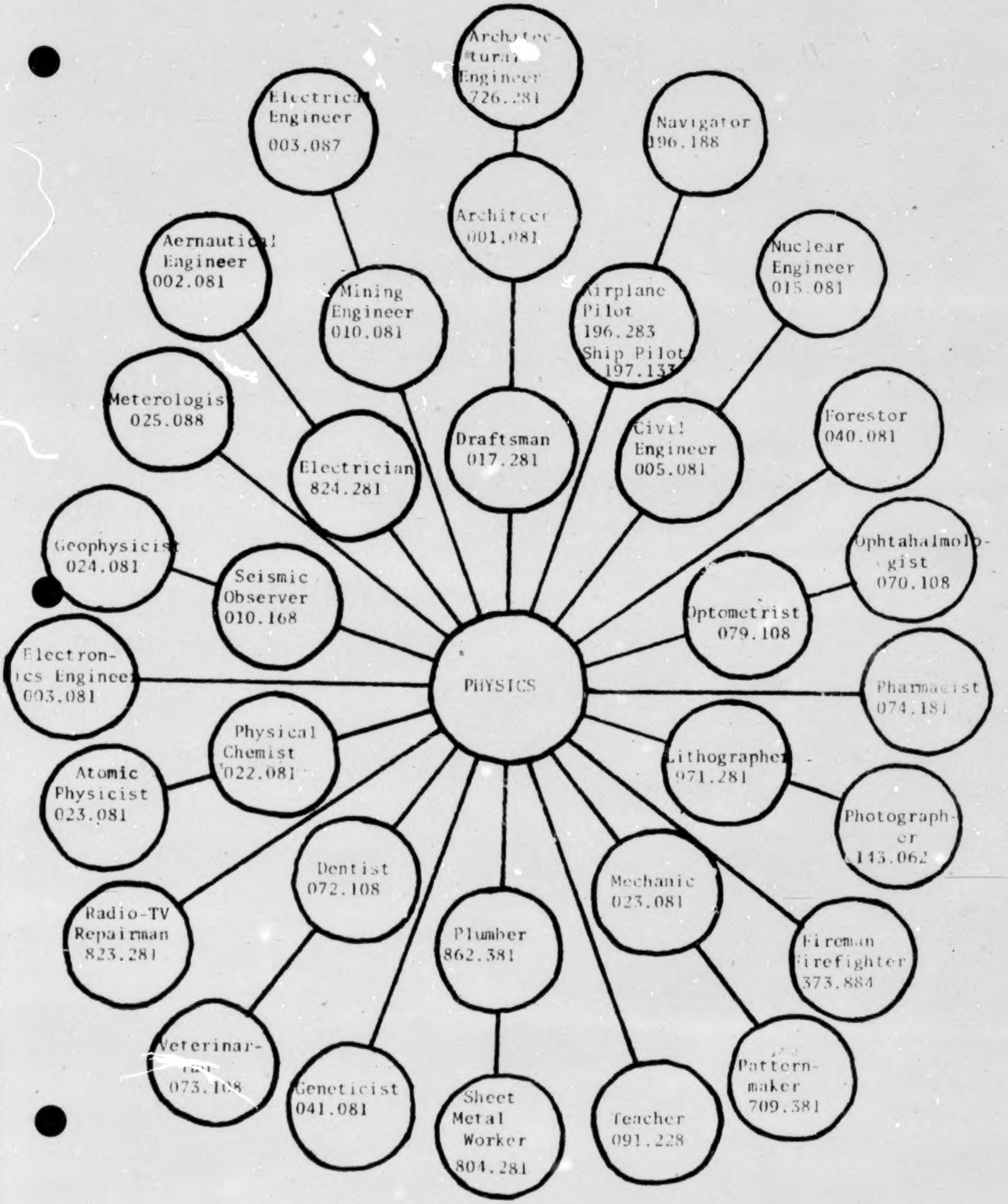
SOME OCCUPATIONS RELATED TO INTEREST AND ABILITY IN CHEMISTRY


Surgeon
Physician
1. 070.101
Bacteriologist
041.081
Chemical
Engineer
008.081
Osteopath
071.108
Biochemist
041.081
Zoologist
041.081
Research
Chemist
022.081
Veterinarian
073.108
Chiropodist
079.108
Research
Nutritionist
077.081
Pharmacist
074.181
Dentist
072.108
Atomic
Scientist
021.088
Geologist
024.081
Scientific
Helper
199.384
Ceramic
Engineer
006.081
Metallurgist
011.281
Science
Teacher
090.228
CHEMISTRY
Forrestry
040.081
Paint
Chemist
022.081
X-Ray
Technician
199.381
Artist
141.081
Laboratory
Technician
029.181
Annealer
573.885
Welder
810.884
Detective
1-376.868
Stationary
Engineer
950.782
Exterminator
389.884
Photographer
143.062
Electroless
Plater
505.884
Lithographer
971.281
Assayer
022.281
Chemical
Processing
Plastics
559.130
Chemical
Salesman
266.258
Criminological
Chemist
054.088

SOME OCCUPATIONS RELATED TO INTEREST AND ABILITY IN BIOLOGY


Biochemist
041.081
Forester
040.081
Fish & Wildlife Service
379.168
Biologist
041.081
Physician Surgeon
1.070.101
Forest Ranger
040.081
Game Warden
379.168
Herpetologist Entomologist
041.081
X-Ray Technician
199.381
Occupational Therapist
079.128
Biological Aide
049.384
Zoologist
041.081
Anthropologist
055.088
Immunologist
041.081
Laboratory Technician
022.168
Dietician
077.168
Home Economist
096.128
Bacteriologist
041.081
BIOLOGY
Botanist
041.081
Dental Assistant
079.378
Tree Surgeon
409.181
Dental Hygienist
078.368
Landscape Architect
019.081
Nurseryman
406.168
Gardener
407.884
Medical Secretary
201.368
Practical Nurse
354.878
Veterinarian
073.108
Horticulturist
040.081
Teacher
091.228
090.228
Registered Nurse
075.378
Curator
102.118
Farmer or Rancher
421.181

SOME OCCUPATIONS RELATED TO INTEREST AND ABILITY IN PHYSICS


Architec-
tural
Engineer
726.281
Electrical
Engineer
003.087
Navigator
196.188
Architect
001.081
Aernautical
Engineer
002.081
Mining
Engineer
010.081
Airplane
Pilot
196.283
Ship Pilot
197.133
Nuclear
Engineer
015.081
Meterologist
025.088
Electrician
824.281
Draftsman
017.281
Civil
Engineer
005.081
Forestor
040.081
Geophysicist
024.081
Seismic
Observer
010.168
Optometrist
079.108
Ophtahalmolo-
gist
070.108
Electron-
ics Engineer
003.081
PHYSICS
Pharmacist
074.181
Physical
Chemist
022.081
Lithographer
971.281
Atomic
Physicist
023.081
Photograph-
er
143.062
Dentist
072.108
Mechanic
023.081
Radio-TV
Repairman
823.281
Plumber
862.381
Fireman
Firefighter
373.884
Veterinar-
ian
073.108
Geneticist
041.081
Sheet
Metal
Worker
804.281
Teacher
091.228
Pattern-
maker
709.381

AGRIBUSINESS AND NATURAL RESOURCES

SUPPORT AND REGULATIONS

Broad area involved in implementing the laws, regulations, and information in the field of Agribusiness and Natural Resources.

- Inspection and Regulatory
- Trading Enforcement
- Market Stabilization
- Information and Marketing
- Conservation
- Education

RESEARCH

This occupational grouping involves systematic, intensive study directed to fuller knowledge of plants, animals, natural resources and the use of these by man.

- Animal
- Fruit
- Mineral
- Soil and Water
- Crop
- Marketing
- Oil and Gas
- Vegetable

FORESTRY

Occupations concerned with developing, maintaining, cultivating, and protecting forests, forest tracts and woodlands, and harvesting their products.

- Forest Use
- Forest Protection
- Fire Control and Prevention
- Harvesting

LAND AND WATER MANAGEMENT

Broad area of occupations concerned with administering public lands and conserving and developing water resources throughout the United States.

- Forests
- Parks
- Rangelands
- Lakes
- Land Use
- Water Use

FISHERIES AND WILDLIFE

Area of occupations concerned with preservation, propagation, and use of fish and wildlife.

- Propagation
- Harvesting
- Protection
- Land Use

MINING AND QUARRYING

Broad area of natural resources which furnish coal, ores, minerals, rocks, gravels, clays, and sand for energy and raw materials.

- Exploration
- Mining Operations
- Quarrying
- Safety
- Machinery Operations
- Product Grading
- Product Handling

PETROLEUM AND RELATED PRODUCTS

Occupations in the production of petroleum and related products for energy to heat, cool, or power our vast machinery.

- Exploration
- Drilling Fluids
- Casing
- Leasing
- Formation Running
- Cementing
- Drilling
- Tool Operation
- Pumping

PRODUCTIVE AGRICULTURE

Occupations in this area involve producing food and fiber for man's use and the production of trees, shrubs, flowers for his aesthetic value.

- Farmers
- Orchardist
- Foreman
- Ranchers
- Vegetable Producer
- Equipment Operators
- Poultryman
- Managers
- Farm Workers
- Ornamental Horticulture

PROCESSING AND MARKETING

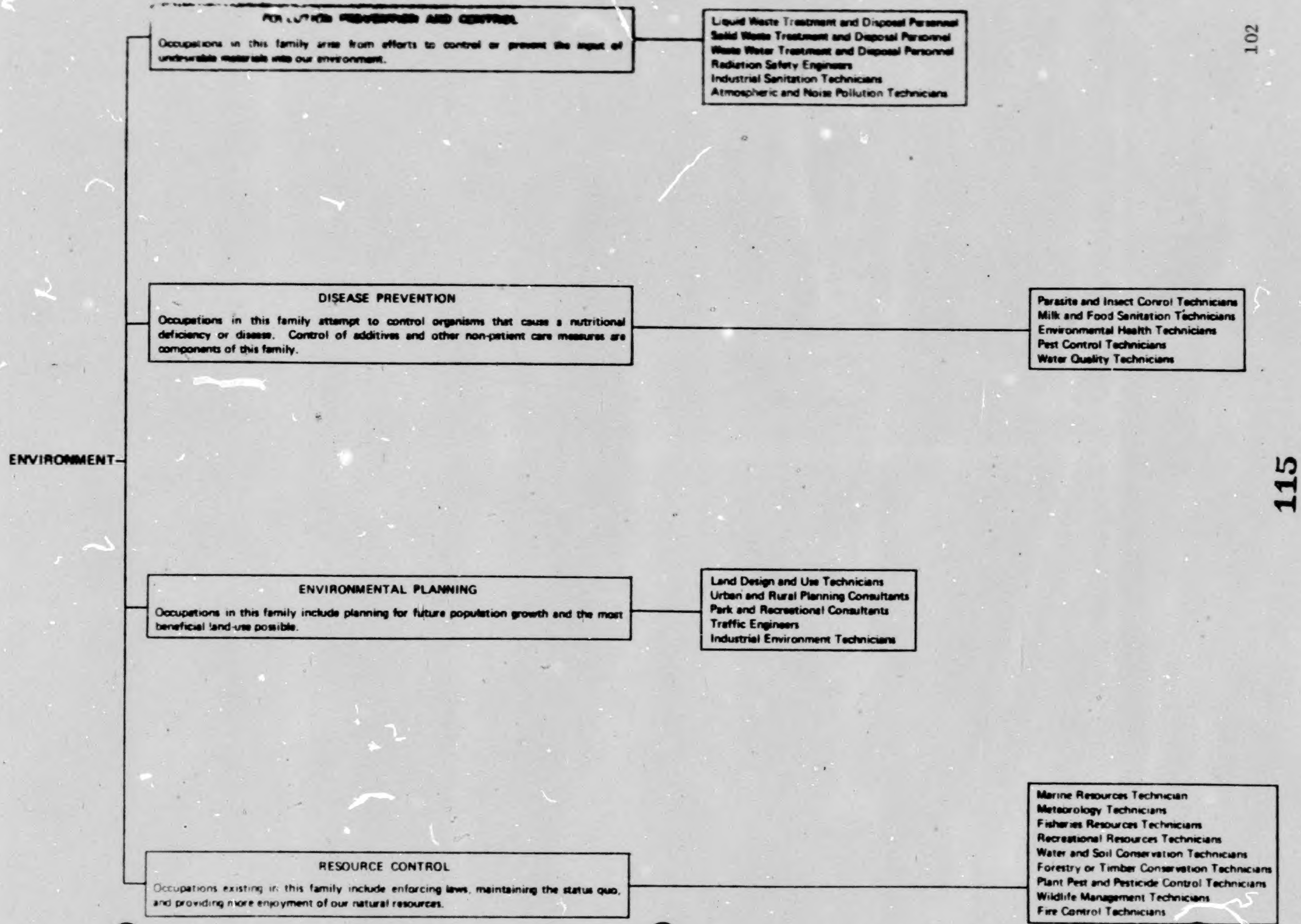
Area of occupations in procurement, purchasing, classing or grading and processing before it reaches the manufacturer.

- Brokers
- Ginning
- Dehydrating
- Buyers
- Compressing
- Storing
- Graders
- Drying

SERVICE

Occupations in this area involve providing consumable supplies, equipment, services, technical assistance and other services peculiar to the production phase of agriculture.

- Hatchery Operation
- Field Service
- Salesman
- Seed Service
- Fertilizer Service
- Feed Service
- Veterinarian
- Mechanics
- Feed Store
- Landscaping
- Artificial Breeding
- Farm Equipment
- Pest Control
- Irrigation
- Farm Communications



ENVIRONMENT

POLLUTION PREVENTION AND CONTROL

Occupations in this family arise from efforts to control or prevent the input of undesirable materials into our environment.

- Liquid Waste Treatment and Disposal Personnel
- Solid Waste Treatment and Disposal Personnel
- Waste Water Treatment and Disposal Personnel
- Radiation Safety Engineers
- Industrial Sanitation Technicians
- Atmospheric and Noise Pollution Technicians

DISEASE PREVENTION

Occupations in this family attempt to control organisms that cause a nutritional deficiency or disease. Control of additives and other non-patient care measures are components of this family.

- Parasite and Insect Conrol Technicians
- Milk and Food Sanitation Technicians
- Environmental Health Technicians
- Pest Control Technicians
- Water Quality Technicians

ENVIRONMENTAL PLANNING

Occupations in this family include planning for future population growth and the most beneficial land-use possible.

- Land Design and Use Technicians
- Urban and Rural Planning Consultants
- Park and Recreational Consultants
- Traffic Engineers
- Industrial Environment Technicians

RESOURCE CONTROL

Occupations existing in this family include enforcing laws, maintaining the status quo, and providing more enjoyment of our natural resources.

- Marine Resources Technician
- Meteorology Technicians
- Fisheries Resources Technicians
- Recreational Resources Technicians
- Water and Soil Conservation Technicians
- Forestry or Timber Conservation Technicians
- Plant Pest and Pesticide Control Technicians
- Wildlife Management Technicians
- Fire Control Technicians

HEALTH

MENTAL HEALTH AND MENTAL HEALTH SERVICES

These careers or occupations cooperate to solve problems that exert such a powerful, disruptive influence on some people's lives that they may bring on physical or mental illness.

- Psychiatrists
- Psychiatric Aids
- Psychiatric Social Worker
- Psychiatric Nurse
- Psychologists
- Psychometrists

MEDICAL AND BIOLOGICAL SCIENCE SERVICES

These occupations support and amplify the whole medical profession. These are medical fact finding jobs, the facts themselves being interpreted by the pathologists.

- Cytotechnologists
- Histologic Technicians
- Blood Bank Technologists
- Medical Technologists
- Biochemistry Technologists
- Microbiology Technologists
- EKG Technicians
- EEG Technicians
- Radiologic Technologists
- Medical Laboratory Assistant
- Physician's Assistant
- Medical Assistant
- Surgical Technician
- Nuclear Medical Technologists
- Veterinary Lab Technician

DENTISTRY AND DENTAL SCIENCE SERVICES

These professions and occupations treat ailments or abnormalities of the gums and teeth and try to prevent their occurrence or recurrence.

- Dentists
- Dental Assistants
- Dental Laboratory Technicians
- Dental Hygientists
- Dental Ceramists

GENERAL HOSPITAL AND MEDICAL OFFICE RELATED OCCUPATIONS

These occupations aid the health services in very general ways such as record keeping and supplies, etc. The personnel may or may not be certified or licensed.

- Supervisor, Central Supply
- X-Ray Clerk
- Diet Clerk
- Nursing Aid
- Central Supply Technician
- Receptionists

MEDICAL EMERGENCY SERVICES

These occupations deal with responsibilities for responding to medical emergency calls, evaluating the nature of the emergency, taking appropriate prompt action to reduce the medical hazards to the receiving station, and serving as technical assistance to the emergency room staff of general hospitals.

- First Aid Attendant
- Ambulance Attendant

ADMINISTRATION OF HEALTH SERVICES

The occupations included within this family are concerned with managing and directing all aspects of health services in hospitals, health departments, and voluntary agencies.

- Hospital Administrator
- Medical Officer
- Administrative Assistant
- Accountant
- Admitting Officer
- Controller
- Credit Manager
- Director of Volunteer Services
- Executive Housekeeper
- Personnel Director
- Public Relations Director
- Purchasing Agent

PERSONAL AND COMMUNITY HEALTH SERVICES

The professions and occupations within this family are concerned with care of the sick and with the prevention of illness in homes, schools, clinics, and industries.

- School Nurse
- Public Health Nurse
- Public Health Educator
- Sanitarian
- Sanitarian Assistant
- Community Services and Health Education Officer
- Home Health Aid

PHARMACEUTICAL SCIENCE AND SERVICES

The professions and occupations included here are instrumental in promoting well being among people in the neighborhood. They are involved in dispensing drugs and health supplies.

- Pharmacists
- Pharmacy Helpers

PROFESSIONAL MEDICAL SUPPORTIVE PERSONNEL

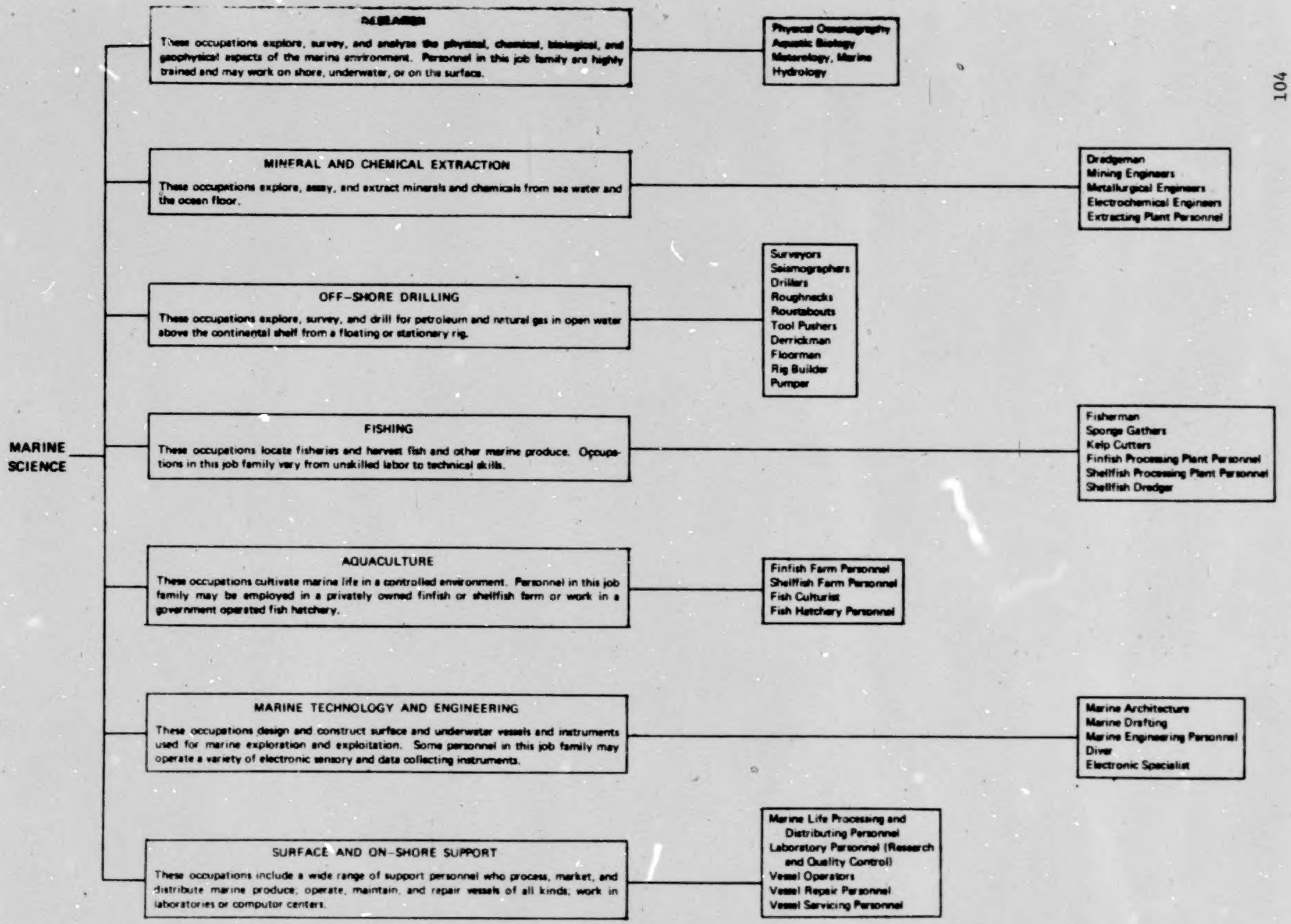
The occupations included within this family are not necessarily involved with direct medical treatment but are most essential in the total picture of medical services. Their particular facet is an integral part of patient care.

- Research Nutritionist
- Dietitian
- Orthotist
- Prosthetist
- Health Physicist
- Audiologist
- Chiropractor
- Optometrist
- Podiatrist
- Speech Pathologists
- Manual Arts Therapist
- Music Therapist
- Occupational Therapist
- Recreational Therapist
- Industrial Hygienist
- Physical Therapist
- Contact Lens Technician
- Audiometrist
- Occupational Therapy Aid
- Inhalation Therapist

MEDICAL PROFESSIONS

The professions included within this family all require strict academic preparation within the medical field and licensure by medical boards. They are concerned with direct medical care.

- Medical Doctors
- Osteopathic Physicians
- Public Health Veterinarians
- Nurse Anesthetist
- General Duty Registered Nurse
- Licensed Practical Nurse



MARINE SCIENCE

RESEARCH

These occupations explore, survey, and analyze the physical, chemical, biological, and geophysical aspects of the marine environment. Personnel in this job family are highly trained and may work on shore, underwater, or on the surface.

- Physical Oceanography
- Aquatic Biology
- Meteorology, Marine
- Hydrology

MINERAL AND CHEMICAL EXTRACTION

These occupations explore, assay, and extract minerals and chemicals from sea water and the ocean floor.

- Dredgeman
- Mining Engineers
- Metallurgical Engineers
- Electrochemical Engineers
- Extracting Plant Personnel

OFF-SHORE DRILLING

These occupations explore, survey, and drill for petroleum and natural gas in open water above the continental shelf from a floating or stationary rig.

- Surveyors
- Seismographers
- Drillers
- Roughnecks
- Roustabouts
- Tool Pushers
- Derrickman
- Floorman
- Rig Builder
- Pumper

FISHING

These occupations locate fisheries and harvest fish and other marine produce. Occupations in this job family vary from unskilled labor to technical skills.

- Fisherman
- Sponge Gathers
- Kelp Cutters
- Finfish Processing Plant Personnel
- Shellfish Processing Plant Personnel
- Shellfish Dredger

AQUACULTURE

These occupations cultivate marine life in a controlled environment. Personnel in this job family may be employed in a privately owned finfish or shellfish farm or work in a government operated fish hatchery.

- Finfish Farm Personnel
- Shellfish Farm Personnel
- Fish Culturist
- Fish Hatchery Personnel

MARINE TECHNOLOGY AND ENGINEERING

These occupations design and construct surface and underwater vessels and instruments used for marine exploration and exploitation. Some personnel in this job family may operate a variety of electronic sensory and data collecting instruments.

- Marine Architecture
- Marine Drafting
- Marine Engineering Personnel
- Diver
- Electronic Specialist

SURFACE AND ON-SHORE SUPPORT

These occupations include a wide range of support personnel who process, market, and distribute marine produce; operate, maintain, and repair vessels of all kinds; work in laboratories or computor centers.

- Marine Life Processing and Distributing Personnel
- Laboratory Personnel (Research and Quality Control)
- Vessel Operators
- Vessel Repair Personnel
- Vessel Servicing Personnel

APPENDIX D

Guidelines For Use of Resource Persons

Letter To Resource Person

Dear ______________________________

My students are studying ____
We would like to have some first hand knowledge about this area. We are very interested in the work that you do at your job. Below are listed some areas that we would like to have included in your talk to the class.

1. Title of job
2. Duties
3. Training or preparation required.
4. Approximate starting salary - salary after ten years (average).
5. Have you been doing this same type of work all of your working life.
6. Demand for such a job.
7. Supply of workers for this occupation.
8. Physical characteristics needed.
9. Social characteristics needed.
10. Do you work alone or with others.
11. Do you need to get along and cooperate with other workers.
12. What school courses helped a great deal in preparing you for this work?
13. How do you feel after a days work? Why?
14. Why do you work?
15. Do you like this job?
16. What are the good and bad points about it?
17. How and where training can be obtained.
18. Leave plenty of time for questions.

Listed below is some information you may find useful.

Subject area ________________
Number of students ___________
Description of facilities and equipment available ______________________

____

Thank you very much for consenting to spend some time with our class.

Sincerely yours,

Teacher

Follow - up of Resource Person

1. Discuss things they learned from visit (what do they know now about this job that they did not know in the past).

2. Discuss:

    a. What are the employment opportunities for these workers?

    b. Would you like this type of work?

    c. What characteristics do you have that would be valuable in this work?

    d. What must you improve on if you were to go into this line of work?

    e. What requirements (educational, physical, etc.) are necessary for this work?

    f. What geographical factors, if any, determine the location of this type of work?

RESOURCE PEOPLE GUIDELINES

Preparation:

1. Make the initial contact.
2. Teacher should obtain background information on person so she can make the introduction.
3. Provide information to the speaker describing the type and number of students, the program, facilities and equipment you can provide, things to cover, etc. (letter for this purpose attached)
4. Cover the area concerning the resource person before he or she comes to the classroom.
5. Give students some general knowledge of this person's field.
6. Talk about questions that they wish to have answered. (general) Have these organized so that all questions can be asked without repetition.
7. If question period lags the teacher should ask questions to bring out things that haven't been covered thus far.
8. Have the resource person ask students "What do you think I do?" before he begins his presentation.
9. Follow - up of field trip for evaluation purposes.

APPENDIX E

Guideline For Field Trips For Career Education

FIELD TRIPS

Guidelines:

I. Set up plans:

A. Plan type of trip
Are students interested in going?
Is trip justifiable? (Can classroom provide same learning?)
Reason for taking trip:
1. Develop awareness of different workers
2. Helping them observe working conditions
3. Awareness of interdependence of workers.

B. Preparation

1. Permission from principal
2. Plans for transportation
3. Permission slips
   Develop form-sheet for the tour of business place
4. Contact business tour establishment
   a. Permission to come and definite date and time
   b. Information given them
      1. Number of children
      2. Age and grade level
      3. What material covered by children previously
      4. Questions they might ask
      5. Workers children may question
      6. Do you have materials you would like us to go over beforehand or hand out on tour.
      7. Safety measures to be observed

C. Pupil/Teacher Preparation

Watch for:
1. Working conditions
2. Training of workers
3. Duties of workers
4. Clothes they wear - appropriate
5. Numbers of workers
6. Safety
7. Do they like this work?

Our preparation for trip:
1. Appropriate clothing
2. Safety - conduct on tour
3. Courtesy (going and at tour base)
4. Departure time

D. Follow-up

1. Did you enjoy the trip and would you recommend trip to others? Why? Why not?
2. Discuss observations (C)
3. Were all your questions answered?
4. Which of these workers would you like to be?
5. What did you learn on this trip that you didn't learn in classroom?

APPENDIX F

Addresses for Suppliers of Resource Material

ADDRESS OF SUPPLIERS OF RESOURCE MATERIALS

Academy Films
748 West Seward St.
Hollywood, Calif. 90038

Allyn & Bacon Inc.
College Division
Rockleigh, NJ 07647

American Book Company
300 Pike Street
Cincinnati, Ohio 45202

American Guidance Service
Publishers Bldg.
Circle Pines, Minn. 44014

Association-Sterling Films
512 Burlington Ave.
LaGrange, IL. 60525

Association Films
660 Madison Ave.
New York, NY 10022

BFA (Bailey-Film Assoc.)
2211 Michigan Ave.
Santa Monica, CA 90404

Benefic Press
10300 W. Roosevelt Rd.
Westchester, IL 60153

Bobbs & Merrill
4300 W. 62nd St.
Indianapolis, Ind. 46268

Careers, Inc.
P. O. Box 135
Largo, Florida 33540

Childrens Press
1224 W. Van Buren St.
Chicago, IL 60607

The Child's World, Inc.
515 N. Front St., Box 711
Mankato, Minn. 56001

Chilton Book Co.
401 Walnut St.
Philadelphia, PA 19106

Churchill Films
662 N. Robertson Blvd.
Los Angeles, Calif. 90069

David C. Cook Pub. Co.
Elgin,
Illinois 60120

Communico
1735 Administration Dr.
St. Louis, MO 63141

Coronet Films
Coronet Building
65 E. South Water St.
Chicago, IL 60601

Coward-McCann, Inc.
200 Madison Ave.
New York, NY 10016

Crowell, Thomas Y.
201 Park Ave. S.
New York, NY 10003

Denoyer-Geppert
5235 Ravenswood Ave.
Chicago, IL 60640

Developmental Learning Corp.
3505 N. Ashland Ave.
Chicago, IL 60657

Dillon Press
108 Washington Ave. N.
Minneapolis, MN 55401

Walt Disney Productions
Educational Film Division
500 S. Buenavista Ave.
Burbank, Calif. 91503

Dodd, Mead & Company
79 Madison Ave.
New York, NY 10016

Doubleday & Company
501 Franklin Ave.
Garden City, NY 11530

Edu-Craft
(See Denoyer-
Geppert)

Educators Progress Service, Inc.
212-214 Center St.
Randolph, Wisc. 53956

Educational Progress Corp.
8538 E. 41st St.
Tulsa, OK 74145

Encyclopaedia Brittanica
Preview/Rental Library
1822 Pickwick Ave.
Glenview, IL 60025

Eye Gate House
146-01 Archer St.
Jamaica, NY 11435

Fearon Publishers, Inc.
2165 Park Blvd.
Palo Alto, Calif. 94306

Filmstrip House
432 Park Ave. S.
New York, NY 10016

Filmstrip of the Month
Popular Science Pub. Co.
355 Lexington Ave.
New York, NY 10017

Finney Company
3350 Gorham Ave.
Minneapolis, MN. 55426

Florida Development Commission
Film Library
Collins Bldg.
Tallahasee, Florida

Follett Educational Corp.
Customer Service Center
Box 5705
Chicago, IL 60680

Ford Market, Inc.
63 St. Anthony Blvd. N. E.
Minneapolis, MN 55421

Gel-Stenn
911-913 S. Hill St.
Los Angeles, Calif. 90015

Ginn & Company
Staler Building
125 Second Ave.
Boston, Mass. 02154

Grove Press
80 University Pl.
New York, NY 10003

Guidance Associates
41 Washington Ave.
Pleasantville, NY 10570

E. M. Hale & Co., Inc.
1201 S. Hastings Way
Eau Claire, WI 54701

Harper & Row Publishers
Keystone Industrial Park
Scranton, PA 18512

Harvey House, Inc.
5 S. Buckhout St.
New York, NY 10533

Hawthorne Book, Inc.
70 Fifth Ave.
New York, NY 10011

Highlights for Children
2300 W. Fifth Ave.
Columbus, OH 43216

Holt, Rinehart & Winston, Inc.
383 Madison Ave.
New York, NY 10017

Houghton Mifflin Co.
1900 S. Batavia Ave.
Geneva, IL 60134

Imperial Film Co.
4404 S. Florida Ave.
Lakeland, Florida 33803

Information Systems & Service
P. O. Box 1231
Milwaukee, Wisc. 53201

Instructo Corp.
Paoli,
Pennsylvania 19301

Jam Handy
2781 E. Grand Blvd.
Detroit, Michigan 48211

Alfred A. Knopf, Inc.
501 Madison Ave.
New York, NY 10022

Laidlaw Brothers
Thatcher & Madison
River Forest, IL 60305

Little Brown & Co.
34 Beacon St.
Boston, MA 02106

Long Filmslide Service
7505 Fairmount Ave.
El Cerrito, Calif.

Marrow Publications
4163 Market St.
San Diego, Calif. 92101

Macrae-Smith Co.
225 S. 15th St.
Philadelphia, PA 19102

McGraw-Hill Book Co.
330 W. 42nd St.
New York, NY 10036

Melmont Publishers
(See Childrens Press)

Milton Bradley Aids
74 Park St.
Springfield Mass. 01102

Modern Talking Picture Service
9129 Lyndale Ave. S.
Minneapolis, MN 55420

National Dairy Council
111 North Canal St.
Chicago, IL 60606

National Forum Foundation
(See American Guidance Service)

National Gallery of Art
Extension Service
Washington, DC

Net Film Service
Indiana University
Bloomington, IN 47405

F. A. Owens Publishing Co.
Dansville,
New York

Oxford Book Co.
387 Park Ave. S.
New York, NY 10016

G. P. Putnam
200 Madison Ave.
New York, NY 10016

Q Ed Productions
P. O. Box 1608
Burbank, Calif. 91505

Radim Films
220 W. 42nd St.
New York, NY 10036

Random House
201 East 50th St.
New York, NY 10022

Richard Rosen Press
29 E. 21st St.
New York, NY 10010

Rider College
Public Information Unit
Trenton, NJ 08602

Scholastic Book Service
2931 E. McCarty St.
Jefferson City, MO 65101

Scholastic Magazine, Inc.
(Weekly Reader)
902 Sylvan Ave.
Englewood Cliffs, NJ 07632

Science Research Assoc.
259 E. Erie St.
Chicago, IL 60611

Scott, Foresman & Co.
3145 Piedmont Rd. N. E.
Glenview, IL 60025

Sextant Systems
(See Information Systems
& Services)

Shell Film Library
450 N. Meridian St.
Indianapolis, Ind. 46204

Silver Burdett Company
460 S. N. W. Highway
Park Ridge, IL 60068

Society for Visual Education
1345 Diversey Parkway
Chicago, IL 60614

Steck-Vaughn Co.
Box 2028
Austin, Texas 78767

Sterling Publishing Co., Inc.
419 Park Ave. S.
New York, NY 10016

Taylor Publishing Co.
Box 597
Dallas, Texas 75221

Texaco Inc.
Mr. Smithwick
1570 Grant St.
Denver, Colo.

Thompkins Films
Box 46611
Los Angeles, Calif. 90046

Trend Enterprises
White Bear Lake,
Minnesota

U. S. Government Printing Office
Superintendent of Documents
Washington, DC 20402

U. S. Dept. of Labor
240 New Federal Bldg.
653 Second Ave. N.
Fargo, ND 58102

Viking Press
625 Madison Ave.
New York, NY 10022

VISTA
1111 18th St. N. W.
Washington, DC 20506

J. Weston Walch, Publisher
Box 1075
Portland, Maine 04104

Franklin Watts, Inc.
575 Lexington Ave.
New York, NY 10022

Weekly Reader
(See Scholastic Magazine)

Westminster Press
Witherspoon Bldg.
Juniper & Walnut St.
Philadelphia, PA 19107

Weston Woods
Newtown Turnpike
Weston, Conn. 06880

Whitman, Albert
560 W. Lake St.
Chicago, IL 60606

John Wiley & Sons
605 Third Ave.
New York, NY 10016

H. Wilson Corporation
555 West Taft Drive
South Holland, IL 60473